RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. XVIII FEBRUARY, 1932 No. 2

ROENTGENOLOGIC EXPLORATION OF THE MUCOSA OF THE GASTRO-INTESTINAL TRACT*

By THE COLE COLLABORATORS

FOREWORD TO AN ADDRESS PRESENTED BY INVITATION TO THE THIRD INTERNATIONAL CONGRESS AT PARIS

MR. PRESIDENT: On behalf of the roentgenologists of America I wish to express the appreciation of my colleagues for the honor you have done our country in assigning to America a consideration of this very important and controversial problem. Realizing as I do that the literature would indicate that very little consideration has been given to this subject by them, this honor is all the more appreciated.

To the American delegates, both my associates and myself wish to express our great appreciation of the honor done us in this assignment.

To the members of the Congress I wish to say that the article here presented is merely a résumé of data that have been assembled in a far more extensive article which will be published serially in RADIOLOGY. The complete data will include the reports of personal communications from many of the foremost American roentgenologists, an extensive study of the foreign literature with translations into English, the assembling of material from the various institutions with which I am associated, and the designing and actual construction of apparatus for applying the localized pressure technic. The assembling of these data and preparation of the illustrations could have been accomplished only by the very hearty and loyal co-operation of those who are directly associated with me. This refers to Robert Earl Pound, M.D., Russell Wright Morse, M.D., Courtenay I. Headland, M.D., William Gregory Cole, M.D., and Ames W. Naslund, M.D., who are herein referred to as The Cole Collaborators, and under which title this complete article will be published.

The honor of presenting this subject would undoubtedly have fallen to the late Preston M. Hickey had he lived, and considering this fact, and the great honor and respect in which Preston M. Hickey was held not only by American roentgenologists but by roentgenologists throughout the world, this complete

*Presented at the Third International Congress of Radiology, Paris, July, 1931, by Lewis Gregory Cole, M.D.

article will be assembled in a bound volume as a memorial to the Dean of American roentgenology, Preston M. Hickey.

The title "Roentgenologic Exploration of the Mucosa of the Gastro-intestinal Tract," which was assigned to us, is an unusual one, probably due to the translation from one language to another, but the term "exploration" is so applicable to the early history of this problem in which the participants were real explorers, that I am more and more pleased with the title as it was assigned.

HISTORY

Reviewing the development of gastro-intestinal roentgenology as presented by Dudley Roberts before the American Gastro-enterological Association in 1928, we find that "Hemmeter must be given credit for first suggesting a way of visualizing the stomach, by means of his intra-gastric bag filled with lead solution. These experiments were not successful but were the first attempts State Normal School, Baltimore, Maryland."[1]

Wolf Becker, in 1896, reported on his experiments with animals, in which experiments he attempted to fill loops of intestine and the stomach with lead solution. These experiments were not successful but were the first attempts at the use of free opaque solutions to make visible the lumen of the hollow viscera.

H. P. Bowditch, Professor of Physiology at Harvard University, in the Fall of 1896, suggested to Walter B. Cannon that the X-rays be used as a means of studying deglutition under normal conditions. This was the beginning of Cannon's famous researches on the motor phenomena of the esophagus, stomach, and intestines. The first public demonstration of movements of the alimentary tract by use of the new method was given in Boston, Dec. 29, 1896. At this time the phenomenon of deglutition as exhibited by the goose when swallowing capsules containing bismuth subnitrate was informally demonstrated by means of the roentgen rays before the American Physiological Society. The first report of the studies of the stomach of the cat was made before the American Physiological Society, May 4, 1897. Cannon was the first to use free bismuth in an opaque meal in animals, and this meal consisted of subnitrate of bismuth mixed with bread which had been softened to a mushy mass by milk, hot water, or thin gravy. Cannon, himself, states that the first *published* account of the use of bismuth subnitrate to make visible the alimentary tract was given by Rumpel, who, on April 20, 1897, published a report of rendering a pathologically dilated esophagus visible by pouring into it 300 c.c. of a 5 per cent suspension of bismuth subnitrate.[2]

[1] We have in our possession a photographic copy of a letter from W. C. A. Hammell verifying Hemmeter's claims.

[2] We have recently received a personal letter from Dr. W. B. Cannon confirming the accuracy of these statements. He has recorded the early history of his work in an article written in 1913 ("The Early Use of the Roentgen Ray in the Study of the Alimentary Canal," Jour. Am. Med. Assn., Jan. 3, 1914, LXII, 1–3).

Apparently independently and contemporaneously, on June 12, 1897, and July 24, 1897, before La Société de Biologie, Roux and Balthazard presented their first reports of the use of the bismuth opaque meal in the study of the motor function of the stomach. Their full report, published in 1898, included studies of the stomach of frogs, dogs, and man by use of the bismuth opaque meal. Their studies are epochal because these writers were apparently the first to study the *human stomach* by means of an opaque meal, using 15–20 grams of subnitrate of bismuth suspended in 100 grams of water or syrup; and secondly, because they were the first to conceive the value of cinematographic study and devised a single plate-changing apparatus which enabled them to make roentgenograms of the frog's stomach at regular intervals during the progress of the peristaltic wave. Although incomplete, their observations of the gastric motor phenomena in man were exceptionally accurate.

Francis H. Williams, of Boston, deserves far more credit than he has ever received for his early recognition of the value of the roentgen rays in medicine and surgery. Perhaps this is because his extreme reticence has prevented him from claiming it or even accepting it. Williams's book, "Roentgen Rays in Medicine and Surgery," published in 1901, is an early classic. Williams, assisted by Cannon, on Sept. 23, 1899, administered an ounce of bismuth subnitrate in a meal, consisting of a pint of milk into which bread had been broken, to a child ten years of age. Fluoroscopic studies were then made, and twelve tracings made of this and another case at various stages of gastric evacuation and in different postures were recorded in Williams's book in 1901. The findings which are there recorded are remarkably accurate as regards the changes in size, shape, and position of the stomach as the result of respiration, change of posture, and digestion. Williams's Fig. 201 is a reproduction of a tracing which had previously been published in the Transactions of the American Climatological Association, 1898. This was a "cut of a tracing made by means of the fluorescent screen from a girl seven years old, showing the outline of the stomach one hour after a meal of bread and milk containing subnitrate of bismuth."

At the Boston City Hospital, where Williams is an attending physician, he has never allowed the title of "roentgenologist" or "radiologist" to be employed. The appointment is recorded as "physician in charge of the X-ray Department." It has always been his conception that the roentgenologist should primarily be a physician rather than a laboratory worker, and that he should be interested in all phases of medicine rather than limit himself to the making and interpretation of roentgenograms. At the present time the justification of his attitude toward this problem is just becoming recognized. It gives us great pleasure to herewith reproduce an autographed photograph of Dr. Francis H. Williams in recognition of his great wisdom concerning the status of the roentgenological physician.

Einhorn, on April 1, 1899, at the office of Willy Meyer, used the X-ray in

a single case to demonstrate a powder blower which he had designed for applying medication to the gastric mucosa.

"In 1898, Holzknecht began using small dose of bismuth in aqueous suspension, especially for the study of the esophagus on a firm basis, but the visualization of the stomach and intestines was not furthered by such meals" (Roberts).

Then for almost half a decade there was a silent era broken only by the contributions of O. Kraus and Lommel. A schematic chart (Fig. 2) helps one to visualize the time relation of the historical events.

Nearly five years later (1904), Rieder, of Munich, with much more publicity and without giving due credit to Roux and Balthazard and no credit to Williams, advocated the use of a meal, the composition of which was almost identical with that previously described and employed by Williams. As a result of Rieder's announcement, this opaque meal of gruel and bismuth became known the world over as "Rieder's meal."

During the following years, 1905–1909, fluoroscopic exploration of the gastro-intestinal tract, with "symptom-complices" as the criterion on which the interpretation of the findings was based, became the vogue, particularly on the Continent. Until 1909, Austria and Germany led the world in this work and among the leaders the names of Holzknecht, Strauss, Rieder, Schwartz, Kreuzfuchs, Groedel, Albers-Schönberg, Haenisch, and Kienböck are outstanding. Many students from all over the world, and particularly from the United States, were attracted to the clinics of Austria and Germany.

An explanation of this popularity of fluoroscopy and symptom-complices is found in the fact that at this time roentgenography of the moving parts was most unsatisfactory. During these years the mechanics of producing X-rays and roentgenograms had not developed sufficiently so that one could obtain satisfactory roentgenograms of the gastro-intestinal tract. Intensifying screens had been employed for the intensification of the photographic effect of the ray in scientific experiments, but these had not yet come into practical use for gastro-intestinal roentgenography. The only two methods of exciting the X-ray tube were by the static machine and by the coil. Neither the static machine nor the coil, however, was powerful enough to make satisfactory roentgenograms in a sufficiently short period of time to avoid blurring incident to the movement of the gastric peristalsis. The slower movement of the colon rendered roentgenography more practical in this region than in the stomach or small intestine. At one time from fifteen to twenty minutes were required to make an exposure of the abdomen as for a kidney stone. By 1903–04, as a result of gradual improvements in apparatus, the time of exposure had been reduced to fifteen or twenty seconds so that roentgenograms could be made of the kidney stone while its motion due to respiration was stopped. Sufficiently rapid exposure to avoid the motion of gastric peristalsis, however, continued to be impossible. Roentgenograms of the stomach were so blurred that they were of little or no diagnostic value. Both methods

of exciting the tube, however, were sufficiently strong to enable one to observe fluoroscopically the size, shape, and position of the stomach, as well as some of the grosser lesions of the stomach, when present.

In the United States the resurrection and further development of gastro-intestinal roentgenology dates from 1905. In that year, Hulst, who had visited Rieder in Munich, informally presented roentgenograms of the gastro-intestinal tract at the annual meeting of the American Roentgen Ray Society in Baltimore. The following year, as his presidential address before the American Roentgen Ray Society, he presented an illustrated comprehensive paper on the roentgenographic method of examination of the gastro-intestinal tract which was so complete that it furnished a new impetus to the method Williams had suggested seven years previously. In this paper Hulst accords credit to Williams for giving one ounce of bismuth in emulsion as early as 1897, and it may be this fact to which Williams refers (p. 359 of his book).

The Advent of the Transformer and Screen.—At the same meeting (American Roentgen Ray Society, 1906) at which Hulst resurrected gastro-intestinal roentgenology, Snook first presented the electrical facts upon which he developed and made practical the transformer which superseded the static machine and coil. Snook developed the transformer in 1907, and this, with the improvement and application of the intensifying screen, enabled exposures to be made in a fraction of a second—thus the blur, due to movement of the stomach, was eliminated.

Prior to the advent of the transformer and intensifying screen, bismuth was suspended in a thick gruel which prevented it from filling the crevices between the rugæ. When roentgenograms that showed greater detail became available, bismuth was suspended in buttermilk, which allowed the mixture to seep into the spaces between the mucosal folds in a manner that it could not do when suspended in thick gruel. Then, for the first time, routine plates were made which showed the rugæ of the stomach. With this technic it was possible to observe any growth that protruded sufficiently deeply into the stomach to cause an irregularity of the contour, which was then termed a "filling defect." It was possible also to note spasm of local regions of the stomach or pressure from without, likewise causing a similar "filling defect." In a filling defect due to spasm (Fig. 3) the rugæ were observed within the deformed area; however, in a filling defect caused by a growth protruding into the lumen of the stomach (Fig. 4), the rugæ were singularly absent. Thus, as far back as 1908–09, the first of the four fundamental findings that will later be described, namely, alteration in contour, and the fourth of these findings, the pattern of the mucosa, were already considered of paramount importance in the diagnosis and differential diagnosis of gastric cancer. There then ensued a long and bitter controversy concerning the relative value of symptom-complices observed fluoroscopically and morphology observed roentgenographically as criteria for the interpretation of roentgenological findings into gastro-intestinal diagnosis.

The main contention on the part of those who objected to morphology observed roentgenographically as the proper criterion for diagnosis was that various roentgenograms of the same stomach differ so much in their appearance that a conclusion could not be drawn from the evidence on a single plate. The proponents of the morphologic basis of X-ray diagnosis proceeded to obviate this difficulty by making a series of plates in as rapid succession as possible. As a result, the factor of change in contour that before had been regarded as a disadvantage, proved in reality to be of great assistance. Subsequently this pliability of the gastric wall became the corner stone on which to build roentgenologic gastric diagnosis, and the making of a series of plates in rapid succession was promptly adopted by some observers as a routine procedure and was called "serial roentgenography."

In 1909, Kaestle, Rieder, and Rosenthal attempted to make roentgenocinematographic films of the stomach under the term "bio-roentgenography." They assembled roentgenograms of a normal individual and reproduced these cinematographically to illustrate the normal motor phenomena of the stomach. Through the courtesy of George E. Brewer and William G. Lyle, who was then private physician to E. H. Harriman, the author had the opportunity to observe this roentgenocinematographic demonstration of Kaestle, Rieder, and Rosenthal. This procedure was applied to the study of the motor phenomena of the stomach. Subsequently I was able to find only one cinematographic film which was a reproduction of serial roentgenograms made by their method. With few exceptions, particularly Meyer of Berlin, this method was not accepted on the Continent as a practical method of roentgenological diagnosis of gastro-intestinal lesions.

In 1909 the author began making from ten to twelve plates of the stomach in each of three postures, the erect posture, the prone posture, and the prone oblique posture in which the patient lies on the right side, as a routine procedure for the study of the stomach in every gastro-intestinal examination. To this method he applied the term "serial roentgenography." Because of the frequent intentional and unintentional misinterpretation and misuse of this term, it is best to define here what is meant by "serial roentgenography" as applied to the stomach. Serial roentgenography is a series of eight or more roentgenograms made of the filled stomach in one posture of the individual, these roentgenograms to be made at intervals of from four to ten seconds, so that in this series all of the phases of the gastric motor phenomenon will be depicted. In order to be of value such a series of roentgenograms must be made with the individual in two different postures, the erect and prone, and in two directions, the postero-anterior and oblique. Serial roentgenograms (Figs. 5 and 6) are of limited value unless they are observed on an illumination box of sufficient size so that they may all be observed at once and compared one with another.

During this time the symptom-complex method was used almost exclusively on the Continent. In America, however, during the period of intense

development of the direct method there were many minor skirmishes between advocates of the two methods. The real battle occurred in Chicago at the meeting of the Mississippi Valley Medical Association in 1912. Skinner was the advocate of the Continental method. Selby, also favoring the Continental method, was roentgenologist at the Mayo Clinic at the time, and, acting under instruction, stated that, while the X-ray was useful in examining bones and lesions of the kidney and chest, it was valueless fluoroscopically and otherwise as a method of diagnosis of gastro-intestinal lesions. Your essayist presented a series of roentgenograms in support of his contention on behalf of the direct method. These roentgenograms illustrated characteristic deformities of the lumen of the gut that are caused by certain pathologic lesions, particularly cancers, gastric ulcers, postpyloric ulcers and gall-bladder adhesions, calling attention to the points of differentiation among them. This brought the two methods into direct controversy, which raged for a number of years. Carman, who succeeded Selby as roentgenologist at the Mayo Clinic, rather elaborately described a group of what he called "roentgenologic signs" as a basis for the diagnosis of gastro-intestinal lesions. These roentgenologic signs represented the principles included in the symptom-complices, but, in addition, included the direct detection of some of the grosser pathologic lesions by fluoroscopic examination. He was the last influential advocate in the United States of the symptom-complex method of diagnosis.

Among the earlier supporters of the direct method of examination, Arial George gave the essayist more support than any other person, particularly in the diagnosis of postpyloric ulcer, and this subject became the storm center of a cyclonic controversy in Boston in 1913.

At the time that the serial method was being established it was noted that the mucosal pattern was of great significance, especially in the diagnosis of organic lesions and the differential diagnosis of malignant lesions from spasm. With the roentgenographic technic it was observed that any growth which protruded into the stomach caused an irregularity of contour known as a "filling defect." Spasm of local regions of the stomach or pressure from without caused a similar defect. In a filling defect due to spasm or pressure, the rugæ were observed within the deformed area; however, in a filling defect caused by a growth protruding into the lumen of the stomach, the rugæ were singularly absent. Thus, as early as 1909 the first of the four fundamental findings (Fig. 4), alteration in contour, as well as the fourth fundamental finding, the pattern of the mucosa (Fig. 3), became of paramount importance in the diagnosis and differential diagnosis of gastric cancer.

A special technic was, therefore, developed to accentuate the mucosal patterns. This special technic consisted of sedimentation of bismuth from a thin watery suspension onto the anterior or posterior gastric wall. Details of this technic will be described later. However, at this time we are submitting illustrations to show that the characteristics of the mucosal pattern were even then considered of significance. The roentgenogram illustrated

in Figure 7 was made on October 13, 1910, and represents the essayist's first attempt to demonstrate the pattern of the gastric mucosa by a special technic. The roentgenograms illustrated compare favorably with the more modern methods of observing the mucosal pattern.

For a time both the serial method and the special mucosal technic were used on the same patient in order to determine which would be the more satisfactory to adopt for the routine procedure. The serial method with a moderately filled stomach, although far more extensive and, therefore, more expensive, seemed to us to be of much greater value than the special mucosal technic, and was, therefore, adopted as our routine method of examination. The special mucosal technic was used only as an adjunct in certain specific cases. Serial roentgenography was also applied to the mucosal technic (Fig. 8).

At this time the spirit of the pioneer was rampant and we moved from one field of exploration to another with such rapidity that we could not "get organized." These were grand and glorious days to which all subsequent exploration seems tame. Now as I review the evidence that we then assembled, it seems as though there is little that has been added in the last two decades. In proof of this we are largely illustrating this communication with roentgenograms made during this early period.

History of Roentgenological Methods for Study of the Mucosa.—A thorough comprehension of modern technic as employed by various investigators of the gastro-intestinal mucosa is essential to an understanding and interpretation of their findings. Åkerlund, 1921, rediscovered the direct method and published an extensive monograph on duodenal ulcer in which he discussed at length the deformities of the "duodenal bulb" incident to ulcer. He directed particular attention to the correlation of the morphological changes observed in the roentgenograms and the anatomic-pathologic changes observed in specimens obtained by operation and autopsy. This work created or marked the beginning of a new era in roentgenology of the gastro-intestinal tract *as practised by roentgenologists on the Continent.* Symptom-complices were forgotten. The direct roentgenological detection of morphologic changes in the wall of the gut became the fashion. This revived on the Continent the same old controversy concerning the relative value of symptom-complices and direct morphology which had been definitely settled in the United States a decade earlier.

Åkerlund mentioned the "method of the thin layer," explaining that by exerting external pressure upon the duodenal bulb all but a thin layer of the opaque contents may be forced out of the cap, bringing to view the markings of the mucosa and ulcer craters which otherwise would be obscured. Baastrup and Rendich, in 1923, published papers dealing with special methods for demonstrating the pattern of mucosal folds in the stomach. These ideas were greeted as a new departure. Many observers became "mucosa conscious." Yet, whenever a certain idea or method becomes the center of inter-

est, it is always wise to look back over the literature to see what is new and what is a revival of someone's previous work.

In the following section we shall present chronologically the history of certain technical methods of roentgenologic examination of the gastro-intestinal tract. The general story of the usual methods has been presented in the previous chapter, so, at this time, more detail will be devoted to the technical methods of study of the mucosa.

Rieder, 1904, noticed after a bismuth enema had been injected, and after the patient had been standing for a few minutes, that the bismuth would precipitate out of solution into the dependent part of the haustral divisions of the colon, and that this outlined the haustral divisions much more clearly than would the solution originally injected. This was illustrated by him at that time.

Holzknecht and Brauner, 1906, used a watery suspension of bismuth subnitrate in the preliminary part of the fluoroscopic study of the stomach (10 gms. bismuth subnitrate in 50 gms. water, to which is added a tablespoon of milk sugar). Palpation of the stomach in the erect posture made possible the visualization of the mucosal folds. After this procedure, and while the stomach still contained the bismuth suspension, they distended the stomach with gas by having the patient ingest an effervescent mixture of from 4 to 5 gms. of tartaric acid and from 5 to 7 gms. of natrium bicarbonate. The usual opaque meal consisted of 400 gms. of milk gruel and 35 gms. of bismuth subnitrate.

Independently, F. M. Groedel and Erich Meyer, in 1908, recommended the substitution of bismuth subcarbonate for bismuth subnitrate. Due to impurities frequently present in the bismuth subnitrate there was the danger of poisoning from the use of this salt.

The essayist, in 1909, with intent to show the mucosal folds, used the principle of sedimentation of bismuth subnitrate from a watery suspension as a special technic for the demonstration of the mucosal pattern on the anterior and posterior walls of the stomach (Figs. 7 and 8).

Bachem and Gunther, 1910, introduced the use of barium sulphate. Cannon used or suggested the use of barium sulphate as early as 1904.

The mixture of opaque salts with gruel formed a stiff meal which did not readily fill the folds of the mucosa of the stomach. For this reason, after about 1908, in the United States, the opaque salts were mixed with buttermilk. This formed a non-sedimenting suspension of fluid consistency.

Stiller, 1910, criticized the use of the bismuth gruel opaque meal, claiming that its use produced an abnormal condition of the stomach due to the high specific gravity of the meal and the astringent influence of bismuth upon the stomach. For several years there was considerable controversy on this subject.

von Elischer, 1911, working to settle this controversy, sought to study the stomach with a contrast substance, of the smallest amount necessary to make

the stomach completely visible, and one which would do away with the high specific gravity and possible chemical irritation of the bismuth meal. He used a thick fluid emulsion mass composed of 75 gms. of "Zirkonoxyd" and from 30 to 40 c.c. of mucilage of acacia. Of this emulsion, from 30 to 40 c.c., which has a weight of from 50 to 60 gms., was injected into the stomach through a tube. The patient was then placed prone in different positions for from five to ten minutes so as to get an equal distribution on the mucous membrane of the stomach. von Elischer found that the emulsion distributes itself over the entire inner surface and fills the folds of the mucous membrane. He considered that this method showed the shape of a gastric tumor more accurately than the usual opaque meal. He also used inflation of the stomach with air in combination with the contrast emulsion.

Forssell, 1913, states: "The relief of the mucous membrane can appear inside of the flatness of the roentgen picture in case a less opaque content is used, or if the content is distributed in a thin layer (von Elischer's method)." Åkerlund, 1921, working in association with Forssell, applied the method of the thin layer to the roentgenologic diagnosis of lesions of the duodenal bulb by using external pressure to displace from the bulb all except a thin layer of the opaque content.

This same method was immediately adopted by Eisler and Lenk, 1921, who used small amounts of barium solution, together with pressure from without, regulated under fluoroscopic control, for the study of the inner surface (mucosal folds) of the stomach.

Baastrup, in a paper read in June, 1923, suggested two methods for obtaining films of the mucous membrane of the stomach. The first method was inflation of the stomach with air saturated with barium powder (similar to a method advanced by Laurell for the examination of the colon). The method was difficult to employ and was soon abandoned. This was similar to the blower demonstrated by Einhorn in 1899. The second method is based upon the physiologic studies of rats' stomachs and the studies on humans of Kaufmann and Kienböck (1911), by which it has been shown that the food latest partaken of gets inside of the food first ingested. "The patient, while still fasting, is given, first, half a tablespoonful of barium sulphate stirred up with water to a smooth, rather thick emulsion; then, shortly afterwards, about seven ounces of smooth rice-flour porridge, of rather thick consistency and flavored with a little powdered cinnamon or sugar, but without any thin fluid."

Rendich, 1923, used a thick emulsion very similar in nature to that previously described by von Elischer. Mucilage of acacia 50 per cent (powdered gum arabic to an equal volume of water) was employed, to which an equal quantity (by volume) of bismuth subcarbonate is added. Honey was also substituted for the mucilage of acacia but did not prove as satisfactory. This emulsion was administered to the patient while he was in the partially recumbent position (10° incline). In this communication Rendich does not

make any mention of the previous work which had been done, particularly of the work of von Elischer, which he practically duplicated, and does not mention that while studying in the Army Training School he became fully conversant with your essayist's method of sedimentation of bismuth from thin watery solutions onto the anterior and posterior walls of the stomach.

Pribram and Kleiber (1927), Hilpert (1928), and Vallebona (1926) have revived the combined use of a barium suspension and air distention. The work of Pribram and Kleiber has been limited to the duodenum, while that of Hilpert and Vallebona has had to do with both the stomach and duodenal bulb. Small amounts of barium suspension are ingested and distributed between the rugæ by manual pressure and then the stomach is distended by air injected through a small tube (Pribram and Kleiber, Hilpert), or by chemical means (Vallebona). This method has the disadvantage of diminishing the prominence of the mucosal relief by the distention of the stomach and duodenum.

Trautner and Hoecker, 1927, introduced into the stomach a tube, the end of which was covered with a thin rubber bladder. The bladder was moderately distended with air, and then a small barium meal was given which would settle between the bladder and the gastric wall.

Certain phases of the work of three observers, Åkerlund, Berg, and Chaoul, demand special attention. Åkerlund and Berg use, as a contrast mixture, barium and water in the proportion of three parts of barium to four parts of water. Chaoul uses a mixture of barium, tragacanth, and water. With all three of these observers the element of pressure is the main part of the procedure in securing the distribution of the opaque medium and in acquiring the optimal demonstration of the mucosal pattern.

Åkerlund originally maintained that the method of applying pressure should be as simple as possible. He used the Forssell fluoroscope, designed for both fluoroscopy and roentgenography. The screen of this fluoroscope is so arranged that it may be pressed against the patient and locked in position with the maintenance of any desired degree of pressure. For localized pressure, Åkerlund inserted between the screen and the patient pads of hard cotton, wool, cork or other non-opaque material. Subsequently, he has developed two other methods of pressure. The first is a cone which may be attached to the back of the fluoroscopic screen, into the end of which cone is mounted an inflatable rubber bag. The finer degrees of pressure are obtained by inflation of this rubber bag. The second method is a larger tube to which has been adapted a skillfully designed carrier containing a rotary Bucky diaphragm, and cassette holder. The desired amount of pressure is first secured by fluoroscopic observation, and then the carrier of the Potter-Bucky grid and cassette is substituted for the fluoroscopic screen. The carrier must be withdrawn and reloaded for each exposure, which renders rapid, frequent exposures impossible.

Berg also uses a fluoroscope designed for both fluoroscopy and roentgen-

ography. Pressure is obtained by a tube mounted on the back of the fluoroscopic screen. His apparatus is so arranged that at the moment he sees a fluoroscopic image which he wishes to record, almost instantaneously a cassette is dropped into place, the transformer setting is changed for roentgenography, and the exposure is completed.

Chaoul exerts pressure through a rubber bag strapped in position by means of a leather belt and under fluoroscopic control. Serial roentgenograms are made with the patient in the prone position on a roentgenographic and indirect fluoroscopic table similar to the Cole table. Chaoul uses the fluoroscope only for localization and for the control of the pressure exerted by the inflated rubber bag.

Colon.—The universal method for roentgenographic examination of the colon has been to fill the colon completely with an opaque clyster. This was originally used by Rieder (1904). With some modifications in the composition of the opaque solution this method has remained the routine procedure. Laurell (1921) and A. W. Fischer (1923) suggested the combined use of an opaque suspension and air injection. Laurell injected the colon with air while it was filled with a barium meal. Fischer administered a barium enema, then had the patient evacuate the enema, after which a small amount of the opaque suspension remained in the colon. He would then inject air into the colon. Some of the opaque suspension would remain as a coating on the wall of the colon and its shadow would be sharply defined from the shadow of the air distending the colon. This procedure, of course, would show the mucosal surface with the lumen of the colon distended and, therefore, with a minimum folding of the mucosa.

The more common procedure has been to study the colon after evacuation of the opaque enema, at which time the mucosal folds are most prominent, due to contraction of the colon, and are well outlined by the thin layer of opaque mixture which remains in the contracted areas of the colon after evacuation. This method has been used extensively by Knothe, Berg, Fischer, and Pansdorf, as well as by Frick, Blühbaum, and Kalkbrenner, and has been routinely used by your essayist since 1915.

In the following sections we present a résumé of our own technical methods and certain principles of procedure which have been found helpful. These are discussed under four headings:

(1) Apparatus—Technic of Serial Roentgenography.

(2) Preparation of the Patient.

(3) Choice and Administration of the Opaque Medium, and Roentgenographic Projection and Posture of the Patient.

(4) Application of the X-rays.

(1) APPARATUS—TECHNIC OF SERIAL ROENTGENOGRAPHY

Considering the numerous exposures which are necessary for serial roentgenography, it is essential for economic reasons that the roentgenograms

should be as small as is practical to show the region being examined. Extremely small films of the cap and valve are not satisfactory except as complementary evidence used in conjunction with larger films of the entire stomach. To show the entire stomach we have used as small as $6\frac{1}{2} \times 8\frac{1}{2}$ films but prefer 8×10 films for this purpose. We prefer single films for each exposure, rather than multiple exposures on a large film. Multiple exposures on large films are used by some roentgenologists to simplify developing. When this is done the large film should be cut later into single exposures so that the roentgenograms may be matched over each other.

In order to use small films some sort of apparatus which enables one to center the stomach under fluoroscopic control is essential. The reflecting fluoroscope with the mirror set at a 45-degree angle is the best and safest device, especially for the prone posture. The 45-degree angle of the mirror is very essential. Our gradual development of this apparatus in the early days of gastro-intestinal roentgenography and the fact that in some simple form at least it was available in all the institutions with which I was associated, prevented me from recognizing how difficult it was to practise serial roentgenography without such an apparatus. However, when my office was burned in 1924, we were compelled to practise serial roentgenography for a time without such an apparatus, and for the first time I appreciated the difficulties of those who attempt to do serial roentgenography without a convenient method for centering the stomach and changing the films or cassettes.

Why manufacturers are unwilling to build the simple device which we have employed for so many years without making some change of their own that renders it impractical, and why roentgenologists shy from the application of the 45-degree mirror visualization of the fluoroscopic screen with some simple film-changing device, and why they attempt numerous complicated impractical substitutes similar to that recently described by Grier at the meeting of the American Roentgen Ray Society, is one of the mental quirks that it is difficult for me to understand.

The serial table which we use in my private office (Fig. 9) was built as an emergency table just after the fire in 1924 and we have used it ever since. It is so simple that it may be built by any carpenter and, therefore, it does not elicit the interest of the manufacturers of X-ray equipment. It is a box 40 inches high, 36 inches wide, and 7 feet long, placed against a partition which may be a permanent wall or a portable partition which separates the table from an operating booth. Figure 10 shows the details of construction.

Any standard cassettes may be used in a lighted booth. Only one set of screens is necessary if the booth is dark, otherwise, 6 or 8 cassettes with 12 or 16 screens are necessary. The same principle is used for the erect position, with the patient standing at the foot of the table.

A more elaborate serial table has been designed and constructed by one of us (C. I. H.) that may be used without a booth, but it requires cassettes unless it is operated in a darkened room (Fig. 11).

A very simple device consisting of a box about 20 by 24 inches and 10 inches deep, with one side open and a bakelite panel in the top, with a mirror to reflect the image of the fluoroscopic screen, and a horizontal shelf to apply the cassettes to the under surface of the patient, is the simplest of all (Fig. 12). With a wooden leaf at each end which folds back on the top, this box can be placed on any table, and when not in use the leaf at each end folds back on the top of the box and it may be placed on the floor and used as a convenient stool or step. This device was first used at General Hospital No. 1 and was dubbed the "Baby Grand."

The value of serial films is very greatly diminished unless one has illuminating facilities so that all the films can be observed and studied at once, and, therefore, an illuminating box 40 inches high and at least 8 feet long is essential.

A much more elaborate roentgenocinematographic apparatus has been installed in the Joseph Purcell Memorial Laboratory at the Fifth Avenue Hospital, through the generosity of his wife, Anna Purcell. True moving pictures of the stomach and intestine may be made with this apparatus on a roll film 10 inches wide. This film is perforated at the edge and may be moved 10 inches between each exposure. By use of a gear shift, similar in size and construction to an automobile gear shift, several different speeds may be used. Exposures may be made at the rate of 4 per second, 3 per second, 2 per second, 1 per second, or 1 every two seconds, or single exposures at any time interval desired. This apparatus may be used either in the horizontal position for the prone or supine postures, or in the vertical position for the erect posture. It is shown in Figures 13 and 14. The large film may be reduced to the standard 31 mm. (Fig. 15) or the sub-standard 16 mm. film and projected either from a standard or sub-standard motion picture projector, showing not only the motion of the stomach but that of the small intestine, and the relation of rapidity of motion of one to the other. [This film was demonstrated at the Third International Congress of Radiology in Paris, July, 1931.]

(2) PREPARATION OF THE PATIENT

For an examination of the esophagus, stomach, and small intestine, the patient should be in an over-night fasting condition, without catharsis. Even with this precaution and in cases without obstruction, small amounts of food residue are not infrequently found to be present in the stomach. In such cases a longer period of starvation may be necessary. After gastric lavage or after expulsion of the test meal, small quantities of the lavage fluid and of the test meal remain in the stomach and blur the outline of the barium shadow. This is particularly important in the study of the surface of the mucosa by the "thin layer technic." Food remnants, mucus, and air bubbles all produce a confusing mottling of the shadow which may completely destroy

all the finer detail. For an examination of the colon or small intestine by colon clyster, the patient should have a thorough catharsis, preferably by castor oil (from 1 to 2 ounces). The cathartic should be given twenty-four hours before the examination is to be made. Waiting twenty-four hours after the giving of the cathartic allows the spastic effect of the cathartic to subside and does away with troublesome spasm during the giving of the enema. Fasting is not essential.

In the colon, as in the stomach, the presence of food remnants (feces) produces a mottling of the contrast shadow which destroys the fine detail and often simulates in appearance certain pathologic findings. We do not believe that the colon can be satisfactorily evacuated by the aid of cleansing enemas. Not only does this method fail to evacuate all of the fecal material, but there is, also, a retention of part of the cleansing solution—which is just as disturbing as the original contents of the colon.

(3) CHOICE AND ADMINISTRATION OF THE OPAQUE MEDIUM AND ROENTGENOGRAPHIC PROJECTION AND POSTURE OF THE PATIENT

As the opaque substance we use, routinely, chemically pure barium sulphate for examination of all parts of the gastro-intestinal tract. We use the single opaque meal, following the progress of this meal through the entire gastro-intestinal tract. This serves to establish the emptying time of the stomach, identifies all parts of the intestinal tract, and indicates the progress of the ingested meal through the small intestine and colon. *If there is any suspicion of an obstructive lesion in the colon, the study of the colon by means of the barium enema should precede the barium meal.*

Esophagus.—For an examination of the esophagus we use a thick paste of barium and water, so thick that the patient cannot swallow it without mixing it with saliva. This thick paste will pass down the esophagus slowly and some of it will remain in the esophagus for a considerable period of time, even with the patient erect. Fluoroscopic and roentgenographic examination may be made in either the erect or supine posture. For the usual roentgenographic examination and to obtain a greater filling of the esophagus it is best to administer the paste to the patient while he is in the horizontal position. For a study of the peristalsis in the esophagus Palugyay elevates the pelvis above the level of the shoulders so that the opaque paste must be forced up an inclined plane.

The esophagus must be studied in the antero-posterior and both oblique projections, exactly as one would step around a tree in order to study its outline.

The demonstration of the mucosal surface by a thin layer depends upon the retention of the opaque substance between the folds of the mucosa or its adherence to the surface of the mucosa. This is difficult to control. We believe this can be best accomplished by originally giving a very small amount

—a level teaspoonful—of the thick paste. This will usually be sufficient to leave a thin coating of barium on and between the folds of the mucosa.

The Barium Meal.—The contour of the stomach, we find, is best shown after a full barium meal—8 oz. by weight of barium to 5 oz. of water—is administered. This amount—7-oz. volume—is less than that employed by most observers but is all that is necessary. Over-distention of the stomach is undesirable as it not only gives a less satisfactory visualization of the stomach and cap, but, also, causes the stomach to obscure an unnecessary amount of upper intestine. This amount of barium insures that the margin of the gastric shadow will be very sharp.

To establish the contours of the various surfaces of the stomach, roentgenograms should be made in the postero-anterior projection and both the right and left oblique projections. For the right, or first, oblique projection, the right side of the patient is against the film; for the left, or second oblique projection, the left side of the patient is against the film.

Roentgenograms made in the postero-anterior projection should be made with the patient both erect and prone, as the profile of the postero-anterior projection is not the same in the erect and prone postures.

The oblique projections may be made with the patient either erect or prone. We believe that the erect posture is preferable, as the anterior and posterior surfaces of the stomach are brought more into profile with the patient erect. In the prone-oblique posture there is a rotation and a lateral shift in position of the stomach.

The roentgenographic examination of the stomach in the erect position should be made as soon after ingestion of the barium meal as the cap and duodenum begin to fill. One of the chief sources of failure to obtain good roentgenograms in the erect posture is that the making of the roentgenograms is delayed by fluoroscopic examination until the gastric muscle has lost its tone and is unable to hold the barium in a column. Early lack of tone and peristalsis may be stimulated by external irritation, either a slap with the hand or a dash of cold water.

When an individual assumes the supine position most of the gastric contents flow back into the fornix of the stomach. This position is very useful when one wishes to study the upper part of the stomach in a dilated state.

The Small Intestine.—The same moderately thick mixture of barium sulphate and water (8:5) serves as the best medium for a roentgenographic visualization of the small intestine. The following conditions must be fulfilled to secure roentgenographic visualization of the small intestine:

1. The opaque medium must be of such composition and consistency that it will pass out of the stomach at a fairly rapid and uniform rate of speed.
2. The medium must be of sufficient consistency to pass evenly—and, preferably, very slowly—through the small intestine.
3. Roentgenographic examinations must be made at intervals which will show the various parts of the small intestines when they are best filled.

Examinations are made routinely at one-half, two, four, and six hours after ingestion of the barium meal, but may be made at more frequent intervals if necessary.

It is *absolutely* essential, if one is to obtain the best roentgenograms of the small intestine, that there be no nutrient value in the menstruum in which the barium is suspended. This eliminates buttermilk, malted milk, and, also, flavoring extracts. Sustained fasting is essential.

Roentgenographic examination of the small intestine is made only with the patient in the prone position. Comparative roentgenograms were made in both the prone and erect postures and it has been found that: (1) The position of the small intestine varied but little in the two postures; (2) the loops of the small intestine were more discretely shown in the prone position; (3) there was no appreciable distortion of the small intestine in the prone position.

It must be remembered, however, that the preceding remarks regarding the position in which the small intestine is studied apply to the use of the barium meal. When one is examining the abdomen to determine whether or not there is an abnormal dilatation of any of the loops of the small intestine by gas due to obstruction, the erect posture is very helpful, in that it allows one to visualize fluid levels in the gas-filled intestine.

Pansdorf varies this procedure slightly in that he does not give the barium meal at one time, but in fractions, the patient taking one swallow every ten or fifteen minutes. This diminishes the bulk of the opaque mixture in the intestinal coils and does not serve as well to demonstrate their caliber.

The *colon* as outlined by the barium meal is examined daily, the roentgenograms revealing the progress of the barium meal through this region.

Visualization of the Mucosal Pattern of the Stomach.—The visualization of the mucosal pattern depends fundamentally upon a satisfactory distribution of an opaque suspension in the furrows between the mucosal folds. There are two methods: (1) The use of a moderate amount of a thin suspension of an opaque salt, through which can be seen the shadow due to displacement of the opaque suspension by the folds of the mucosa, and (2) the methods of the "thin layer."

In roentgenograms made with the first method the folds are shown as less opaque linear shadows within the flat whiteness of the gastric shadow. This method has the disadvantage that the shadow of the opaque suspension as a whole lacks sharpness because of the small content of opaque material.

The method of the "thin layer" may be applied in several ways. The bulk of a full or small sized barium meal may, by external pressure, be displaced from a local region of the stomach or cap, leaving only a thin layer which does not conceal the shadows of the thicker layers of opaque substance which are present in the furrows between the mucosal folds.

The more common and satisfactory procedure is to give only a small amount of the barium-and-water mixture (8:5), a sufficient amount to fill

the furrows but not enough to cover the folds. If too little of the barium mixture is used, some of the furrows may not be filled. If too much is employed, the mountain peaks of the mucosal folds may be so flooded by the mixture as to be completely obscured in the roentgenogram.

The greatest difficulty with this method is to secure a satisfactory distribution of the small amount of barium mixture in the stomach. Special methods for the distribution of the barium have been devised to show the rugæ most clearly and to emphasize the mucosal pattern.

When a small amount of the barium mixture is administered, it passes along the lesser curvature in such a manner that this region has been termed the gastric pathway, and trickles into the by-ways of the crinkled rugæ along the greater curvature. Eventually the remainder of the paste is deposited in the antrum: some, perhaps, passes into the cap. This method of distribution depends upon the normal gastric motor phenomenon. Most observers have the patient assume various postures so that the mixture may flow into the furrows with the aid of gravity. Some observers, with more or less success, have attempted to assist Nature by spreading or smearing the barium paste over the surface of the mucosa by using deep manual massage of the abdominal wall, either with or without fluoroscopic control.

Distribution of the Opaque Salt by Sedimentation.—This method was originally employed by the author when he attempted to develop the special mucosal technic previously mentioned. This is accomplished by administering through a drinking tube to a patient in the prone posture, on a flat table, about 1 gram of bismuth subnitrate or bismuth subcarbonate in 4 oz. of water. This amount of solution moderately distends the stomach. In from fifteen to twenty minutes the bismuth settles or gravitates onto the furrows between the mucosal folds of the anterior gastric wall. If the correct amount of bismuth has been used, it just fills the furrows between the rugæ and the results illustrated in Figures 7 and 8 are obtained. If too large an amount of bismuth is used in 4 oz. of water, the furrows are more than filled and the mucosal folds are covered, so that the results are unsatisfactory. A modification of this method is to fill the stomach more completely with a watery solution of 1 gram of bismuth to 8 oz. (120 c.c.) of water. With this larger amount of water, the mucosal folds are smoothed out so that the bismuth settles onto a relatively smooth surface. Then, as the water is drawn off by means of a small tube, the stomach diminishes in size, the mucosa is thrown into folds, and the bismuth becomes incarcerated within the furrows between the folds. We have found that the sedimentation of the bismuth is accelerated if the required amount of dry bismuth is placed on the tongue and then washed down with the 4 or 8 oz. of water.

A preliminary washing out of the stomach with an alkaline solution, in order to dissolve the mucus, makes this method even more satisfactory. The mucosa of the posterior gastric wall may be likewise demonstrated by placing the patient in the supine posture.

The Barium Clyster.—The solution which we use is a suspension of barium sulphate in mucilage of acacia and water: 10 ounces by weight of barium sulphate, 7 ounces of mucilage of acacia, and 32 ounces of water. This solution should be warmed to body temperature before injection. The injection is made by gravity through a rubber enema tube to the end of which is attached a funnel. The rapidity and pressure of the injection is controlled by the height of the funnel above the patient's body. The use of the funnel allows one to see at all times whether or not the suspension is going in rapidly, or slowly, or not at all. Back-flow of the suspension into the funnel is due to temporary contraction or spasm of the colon. The suspension should be injected slowly and at a low pressure. If this is done, one rarely fails to fill the normal colon completely. The injection is followed under fluoroscopic control and should be stopped as soon as the cecum is filled. Over-distention of the colon is a disadvantage.

When the colon is completely filled, a roentgenogram is made with the patient in the prone position, the ray being projected in the postero-anterior direction. As in other parts of the intestinal tract, we are dealing with a tube which must be viewed from several angles to bring its several contours into profile. This is particularly true of the colon because of the usual overlapping of the transverse colon and the ascending and descending colon at the hepatic and splenic flexures, respectively. Therefore, roentgenograms should be made in both the right and left prone-oblique positions, with sufficient rotation of the patient's body to make visible, in turn, these two flexures of the colon. This procedure is an excellent protection against the very real possibility of overlooking a lesion due to overlapping of the different parts of the colon.

After these roentgenograms have been made, the colon should be evacuated, either by the patient or by drainage through the enema tube. The study of the colon after evacuation is just as important as the study of the filled colon. It is essential to know whether or not there is an unusual retention of any division of the colon, particularly proximal to the hepatic flexure. In addition, a thin layer of the barium mixture remains on the mucosa of the colon and gives an excellent demonstration of the mucosal pattern of the contracted colon. The studies by Knothe, Berg, and Frick, Blühbaum and Kalkbrenner of the mucosa of the colon have all utilized this slight retention of the opaque mixture after evacuation.

A. W. Fischer (1923) recommends the combined use of an opaque mixture and air injection. He uses the usual opaque mixture. After evacuation, he studies the mucosal pattern of the contracted colon, and then injects air into the colon. A thin layer of opaque mixture adheres to the surface of the mucosa and when the colon is distended with air, one obtains, at times, an excellent visualization of the mucosal surface. The results are difficult to control and duplicate.

(4) APPLICATION OF THE X-RAYS

Roentgenograms may include an entire region, such as stomach, cap, and duodenum, or they may be limited to small localized areas three or four inches in diameter. Films of an entire region may be made with or without a grid. Those made with a grid are more brilliant, but because of the increased length of time required for exposure, and other unsatisfactory grid characteristics, they are less diagnostic than the roentgenograms made without the grid and with the use of a cone of just sufficient size to include the stomach, cap, and duodenum. A thorough consideration of this subject would in itself require a book. We shall, therefore, mention only the salient principles.

Secondary radiation is the bane of the roentgenologist's existence—particularly true in regard to the gastro-intestinal tract. Five factors have been employed to prevent the development of secondary rays or to obviate their detrimental effect: (1) The gas tube, (2) the cone, (3) compression, (4) the grid, and (5) the close apposition of the film to the opaque medium.

The gas tube generates fewer secondary rays per cubic space radiated than any other tube because of the fact that the indirect rays generated in the gas tube are of very low penetration and are easily eliminated by the cone.

The cone is one of the oldest and is perhaps the most important device for obviating secondary radiation. It utilizes the principle of diminishing the surface area of the region that is being exposed. The smaller the cone, the smaller the surface area (or cubic space) radiated, consequently, the less the secondary radiation, the more brilliant the roentgenogram.

Compression is used to diminish the thickness of the part being exposed. When combined with the cone it diminishes to a minimum size the cubic space exposed to the X-ray. The smaller the cubic space radiated, the less is the secondary radiation. Compression also diminishes the time required for exposure. Compression may be applied either between the tube and the patient's back, or to the patient's abdomen, as will be described later.

The grid tends to eliminate secondary radiation. The larger the area that is exposed to radiation, the more valuable is the grid. Conversely, the smaller the area, the less valuable is the grid. The grid has its advantages and its disadvantages. It increases the time of the exposure twofold or threefold, thus allowing the motion due to peristalsis to become a detrimental factor. It increases also the distance of the film from the patient, causing distortion.

Close apposition of the film to the region under observation not only lessens the amount of secondary radiation, but is an application of the following law of optics, "the nearer an object is to a screen or film, the clearer and more distinct is its shadow."

One or more of these principles to minimize the effect of secondary radiation are applied by the various observers, especially by those who have constructed their own apparatus. The ingenious apparatus designed by Åkerlund utilizes two of these five principles for obviating the detrimental effects of

secondary rays. His device employs compression in the following manner. Between the fluoroscope or film and the patient he causes pressure to be exerted on the abdomen, which is soft and compressible, rather than on the patient's back, where the ribs and spine render it practically incompressible. This procedure is not new. To it, however, Åkerlund added a revolving grid located in the end of the cylinder that is pressed against the patient. For the perfection of this he deserves great credit. By the use of this apparatus, one diminishes the detrimental effects of the secondary rays that are generated in a relatively large region. However, the revolving grid that increases the brilliancy of the roentgenogram, as does any other grid, likewise adds to the time of exposure and likewise adds the disagreeable grid characteristics, while its large size prevents local application of pressure. Some of the prominent observers who previously used this apparatus, realizing that the smaller the area of observation, the less valuable the grid, discontinued its use. This method, although employing two of the five methods of diminishing the detrimental effects of secondary radiation, namely, compression and the grid, does not utilize the other three, that is, the tube, the cone, and the close apposition of the film to the opaque medium.

Berg employs a method similar to Åkerlund's, but without the revolving grid. Of the five methods of diminishing the detrimental effects of secondary rays, Berg depends chiefly on compression applied to the abdomen by a cylinder or cone mounted on the back of the fluoroscopic screen. In doing this he has exaggerated *reversely* the fifth principle by placing the film away from the patient. Berg, with this apparatus under fluoroscopic control, is able to exert any desired pressure on the stomach or cap, displacing the bulk of the barium mixture and leaving only that which is caught in the furrows between the mucosal folds. He is enabled thus to make a thorough fluoroscopic exploration of the gastric mucosa. When any interesting area is observed fluoroscopically a film is substituted for the screen and a radiographic record is made. In this procedure only one method of obviating the detrimental effects of secondary rays is employed, namely, compression. By this method Berg gets a gross elimination of the widely scattered secondary rays, and he speaks of the Bucky effect of the cylinder. A close scrutiny of the illustrations appearing in Berg's book indicates that his most brilliant roentgenographs are those in which his special compression apparatus has not been used.

It should be noted that in both Åkerlund's and Berg's compression cylinders the fluoroscopic screen or film is inserted at the end of the cylinder and is at a very considerable distance from the patient; therefore, the screen and film are not in close apposition to the region being examined. In Åkerlund's device the film is separated from the patient by the thickness of the grid and the housing over the grid. The fifth principle—close apposition of the fluoroscopic screen or film to the part being examined—which is perhaps the most important of the five principles for eliminating secondary radiation, is em-

ployed by neither Åkerlund nor Berg, and the detrimental effects are exaggerated by both of their methods.

Bearing in mind the five factors enumerated as aids to the diminution of the detrimental effects of secondary radiation, one of us (C. I. H.), at the essayist's suggestion, has designed and constructed a device for examining fluoroscopically and roentgenographically small localized areas of the gastrointestinal tract, particularly the stomach and cap (Figs. 16 and 17). The principles employed in this apparatus are as follows:

(1) An X-ray tube is used that generates fewer secondary rays in the patient than any other tube, namely, the gas tube.

(2) A cone is used which has the smallest diameter that will cover a 3¼ × 4 inch film at a 24-inch distance.

(3) Compression is exerted on the soft, compressible abdomen by a rectangular piston which has rounded corners. No compression is exerted by the small cone attached to the tube holder.

(4) No grid is used.

(5) The device is so arranged that the intensifying screens and fluoroscopic screen are located at the end of the piston which is pressed into the abdomen. Thus, with pressure, the film and screens are embedded well within the normal contour of the abdomen and in close contact to the opaque medium.

With this device we not only see the exact image which we desire to radiograph prior to the rapid insertion of the film, but we also see the actual fluoroscopic image recorded on the film.

An old-fashioned gas tube is employed because this is the only tube in which indirect rays are not generated on the back of the target. The elimination of indirect rays from the back of the target diminishes the quantity and penetration of the secondary rays generated in the patient. The gas tube is the only tube used for roentgenographic work in the institutions with which I am associated, except in connection with portable and dental apparatus.

The second principle involved in our device for eliminating secondary radiation is the limitation to a minimum size of the surface area exposed to the rays. This principle is accomplished by employing the oldest of all methods for obviating secondary radiation, namely, a cone of such small diameter that it barely covers a 3¼ × 4 inch film at a 24-inch distance.

The third principle, namely compression, is applied to the soft parts of the abdomen which are compressible, and in this manner the distance between the film and the posterior surface of the patient is reduced to a minimum. Secondary rays are developed in proportion to the cubic space that is radiated; therefore, with a cone of minimum size and with the desired maximum amount of compression, the cubic space radiated is reduced to a minimum. Thus the quantity of secondary rays generated is reduced to a minimum.

The fourth principle, namely the grid, is not used because, as we have stated previously, the grid is chiefly of value when large areas are to be

roentgenographed. By using this apparatus only a very small area is exposed and so the grid would be of little or no value, and actually detrimental.

The fifth principle, that is, close apposition of the film or screen to the part being examined, is employed, bringing about not only a diminution of the secondary rays generated between the stomach and the film, but also a more brilliant and clear-cut image in accordance with the optical law, "the nearer the film to the object, the sharper the shadow."

Pressure.—As regards the roentgenological examination of the gastro-intestinal tract, compression and pressure are entirely different; at least, we shall so regard them. Compression is applied to diminish the thickness of the part and so reduce its secondary rays. Pressure is employed to displace the bulk of the opaque medium (barium) from the lumen of the gut and to accentuate the mucosal pattern. Pressure is usually applied to small areas as by Åkerlund and Berg, although Chaoul applies pressure to larger areas by means of a large, inflatable, flat rubber bag which is strapped to the abdomen. We use both, as is shown in our illustrations. Pressure as applied by Åkerlund and by Berg is usually under fluoroscopic control, that is, the operator personally views the region fluoroscopically. When he sees some finding which is of interest he substitutes a film for the screen and makes a small roentgenograph for a permanent record. While he is making this roentgenograph he can personally orient himself and determine the exact region that is being examined. However, if the small films, especially those of the stomach, were to be observed without a knowledge of the exact region in which they were made, as observed fluoroscopically, it would be difficult to identify the region.

Pressure gives a different set of findings for a criterion on which to base radiographic diagnosis, and undoubtedly it allows a more comprehensive study of the mucosal folds and the surface of the mucosa. In our own experience and by an intensive study of the illustrations submitted by others, we find that there are very few instances in which the diagnosis of an organic lesion has been established by pressure in cases in which it has not been established by radiographs made without pressure.

The manner in which the rugæ of the stomach diverge as they approach certain types of carcinomatous growths or the manner in which they converge toward the crater of an ulcer at a certain late stage in its process of repair, are findings of scientific interest. They do not, however, alter the diagnosis as established by the routine method without pressure. It must be remembered that visualization of rugæ and application of pressure are not synonymous. Indeed, it is often more difficult to determine the size and shape of the crater of an ulcer when the barium is displaced by pressure than it is when the crater is filled by moderate distention of the stomach without pressure.

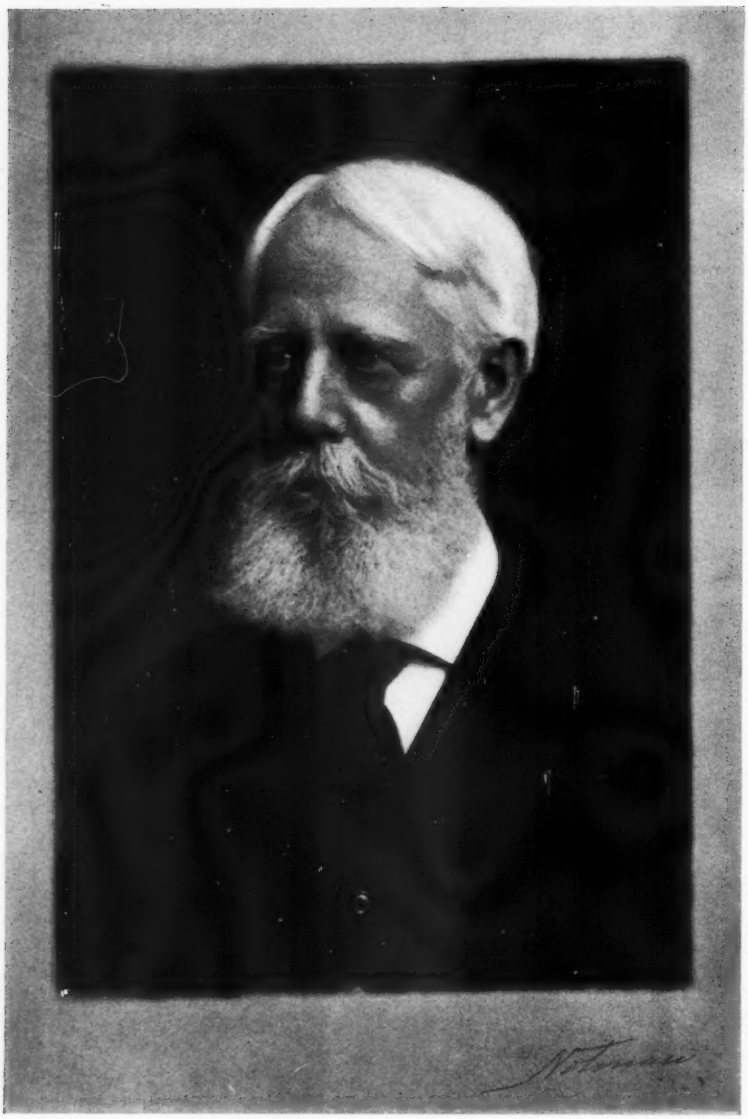
External pressure—whether achieved with Åkerlund's rotary grid, the cylinder used by Berg, a rubber bag strapped to the abdomen as recommended by Chaoul, or with our own apparatus constructed by Headland—has both

its advantages and disadvantages as a method of showing or exaggerating the pattern of the mucosal folds. It is a moot question whether or not it should be used. Some observers depend very largely on gradation or dosage of external pressure to displace the bulk of a small opaque meal from a local region so that the mucosal pattern of local regions may be observed fluoroscopically or roentgenographically. Small roentgenographs made with various devices show more contrast than roentgenographs of full size, but with the grid interposed or with the film at the end of the cylinder away from the patient, detail is diminished and distortion results. Even when one is able to obtain small roentgenographs with great brilliancy and without loss of detail, there is still much question in my mind as to whether the findings aid or hinder in the diagnosis of gastro-intestinal lesions. Although numerous articles have been illustrated by brilliant, localized roentgenographs, very few observers have recorded any systematic comparison of these small local films obtained by pressure, with routine roentgenographic examinations, serial or otherwise.

We have run quite a large series of cases, making twelve small roentgenographs of the cap with varying degrees of pressure (Figs. 18 and 19), in addition to the routine serial roentgenographic examination. By comparing the findings of the cap, as observed by both methods, we have come to the following conclusions.

Whereas small roentgenographs are much more economical, they are limited to a small region and difficult to orient, except in the cap. The small films of the stomach are almost valueless inasmuch as they cannot be oriented except by comparison with a large film which shows nearly as much detail. The small films furnish brilliant contrasts and are fascinatingly interesting to study, especially with the old-fashioned hand stereoscope to which these $3\frac{1}{4} \times 4$ inch films are so well adapted. Nevertheless, we have yet to find a case in which the small films, made with varying degrees of pressure, have caused us to alter the diagnosis as based on serial films of full size made without pressure. Pressure interferes, in many instances, with the manner in which a normal or pathological cap behaves when it receives a squirt of barium through the pyloric valve, or when its distal two-thirds are evacuated by a broad peristaltic wave. A cap under abnormal external pressure does not act normally in response to the gastric motor phenomenon. Thus external pressure employed to exaggerate the mucosal pattern becomes a two-edged sword with which, I fear, many will cut their fingers!

(To be continued)



James H. Williams M. D.

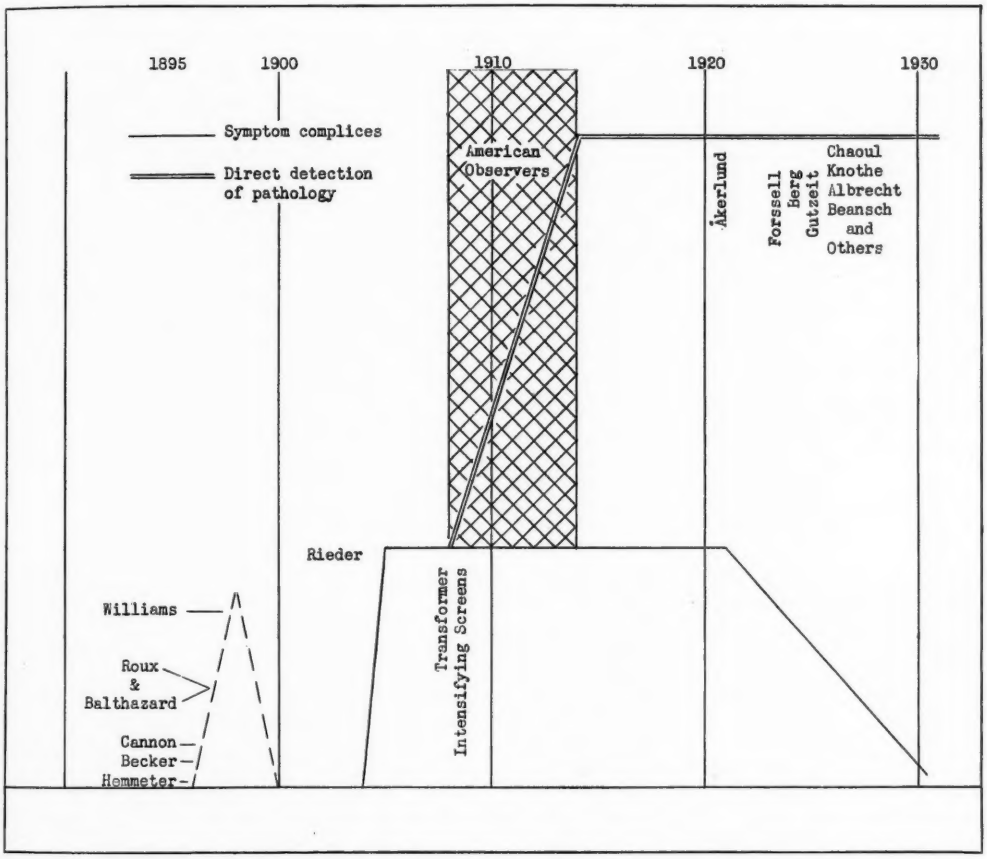


Fig. 2. Chart showing graphically the time relation of periods of advance in the roentgenological diagnosis of lesions of the stomach and cap. During the period between 1896 and 1900 observations were made as to the use of the X-ray and the opaque meal for making visible the stomach. From 1900 to 1904 was a period of silence. Rieder's work in 1904 resurrected the use of the X-rays for study of the gastro-intestinal tract, and for the first time roentgenologic examination was used for diagnosis, the criterion for diagnosis of pathologic lesions being the so-called "symptom complices." Satisfactory roentgenography of the stomach was possible only after the introduction of the transformer and intensifying screens in 1908. Roentgenographic examination of the stomach made possible the direct detection of abnormal morphologic changes in the wall of the gut. The period from 1908 to 1914, indicated by the cross-hatched area on the chart, was the "red letter days" of roentgenographic exploration of the gastro-intestinal tract.

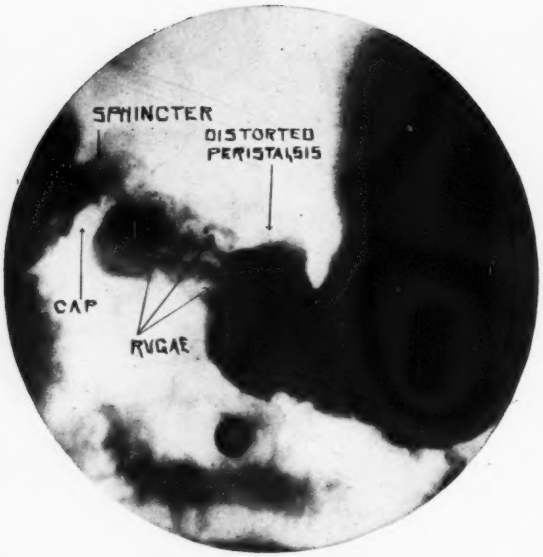


Fig. 3. Spasm of the stomach.

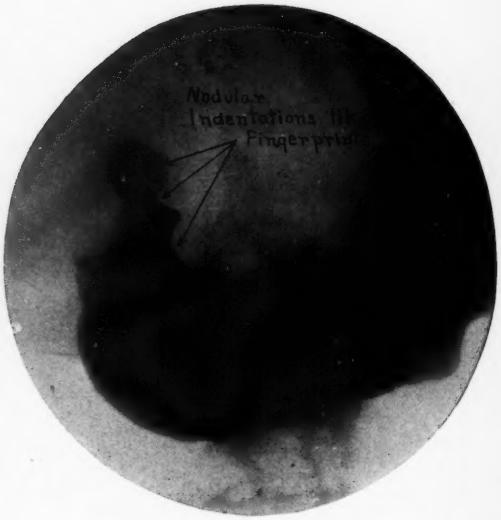


Fig. 4. Cancer of the stomach.

Fig. 3′. Spasm of the stomach.

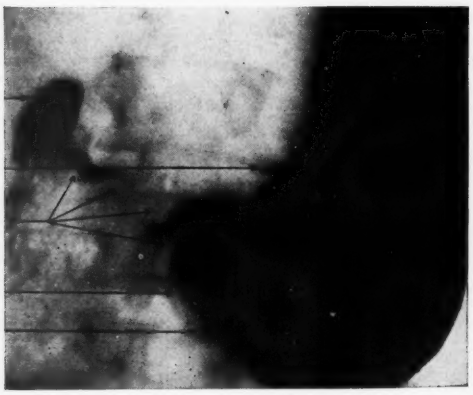
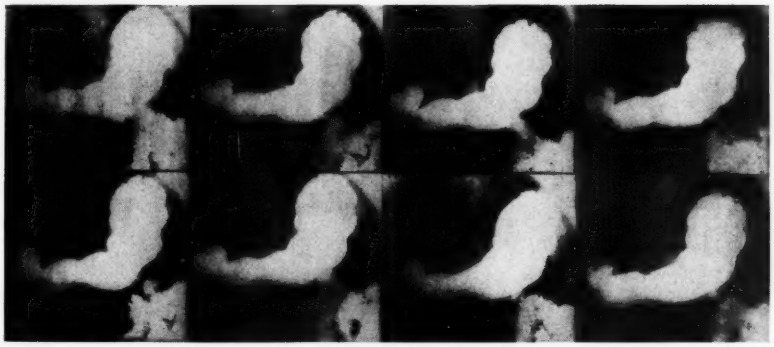


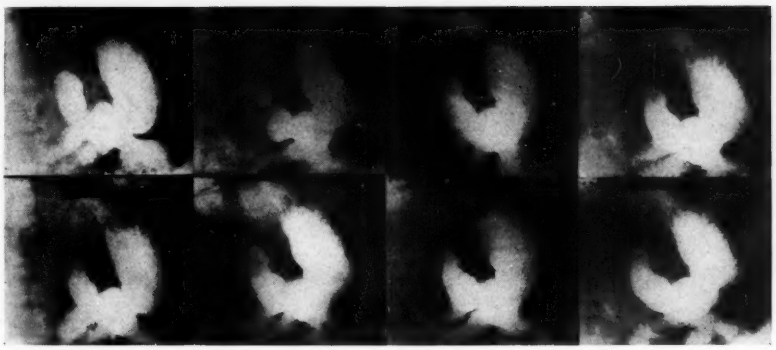
Fig. 4′. Cancer of the stomach.

The changes shown in the above roentgenograms were designated as filling defects, due either to spasm as shown in Figures 3 and 3 prime, where the rugæ are observed more distinctly than usual, or to a cancer protruding into the lumen of the stomach as shown in Figures 4 and 4 prime, where the rugæ in the involved area are completely obliterated. These figures illustrated an article originally published in 1912, and these reproductions are made from the same photo-engraved blocks.

Erect



Prone



Prone oblique

Fig. 5. Serial roentgenograms of the stomach in the postero-anterior and right oblique directions with the patient prone, and in the postero-anterior direction with the patient erect.

Fig. 6. Roentgenograms showing the passage of the barium meal through the small and large intestine, and examination of the colon after administration of the opaque clysma and after its evacuation indicate, together with Figure 5, what the essayist originally designated as serial roentgenography of the gastro-intestinal tract.

Fig. 7. Patient, Mr. S., Oct. 13, 1910. This roentgenogram was the essayist's first intentional attempt to demonstrate the pattern of the gastric mucosa by a special technic. The patient ingested a suspension of one gram of bismuth subnitrate in four ounces of water, and was placed in the prone posture for twenty minutes, the heavy bismuth settling out of suspension onto the furrows between the mucosal folds of the stomach.

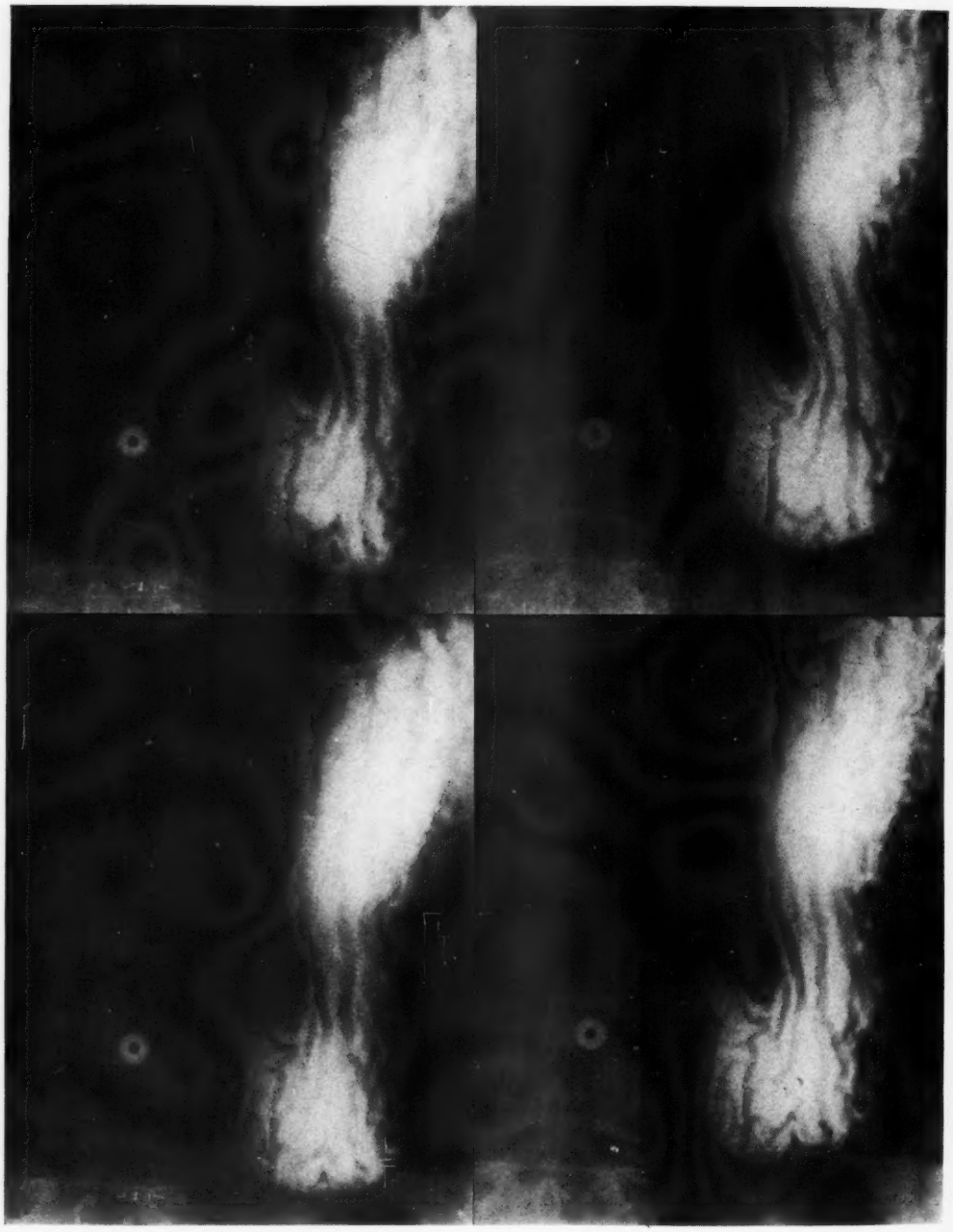


Fig. 8. Serial roentgenography, *i.e.*, multiple roentgenograms of the stomach in combination with the special mucosal technic as illustrated in Figure 7, shows the constancy of position of the mucosal folds except as they are disturbed by the progressive peristaltic contractions.

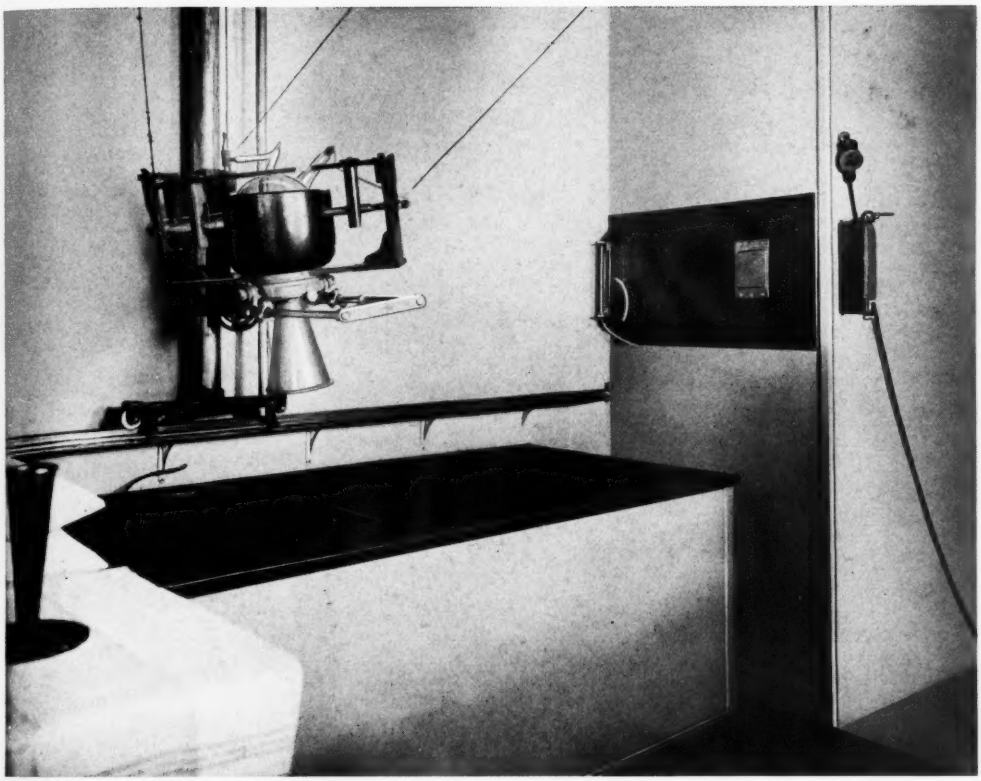


Fig. 9. Serial table; built as an emergency table just after the fire in 1924, since which time it has been in constant use. This table is a box 40 inches high, 36 inches wide, and 7 feet long, built into a wall concealing a dark operating booth. The bakelite panel in the top of the table is the top of the film-changing device shown in detail in the cross-sectional drawing (Figure 10).

The bakelite panel in the wall at the end of the table conceals the film-changing apparatus for making serial roentgenograms of the patient in the erect posture. This film-changing apparatus is a cassette built into the wall, entirely similar to the erect film-changing apparatus shown in the Model Table designed and constructed by Headland (Figure 10). The back of the cassette is made of bakelite, and carries the back intensifying screen in front and a fluoroscopic screen behind. The fluoroscopic screen is covered with lead glass. The patient is held tightly in position by the belt shown in the picture. The holders of the belt are offset from the wall so that the angle of the belt is not acute and will not slip easily. The holder on the right side, which contains the ratchet gear, is mounted on hinges, so that it may be swung back out of the way into the position shown in the photograph.

The compression device designed and constructed by Headland can be seen partially protruding through the bakelite panel in the end wall. The detailed construction of this is shown in Figures 16 and 17. The small cone on the table in the foreground is used when we make the small compression roentgenograms and will just cover a 3¼ x 4 inch film at a 24-inch distance.

The small rubber bag shown lying on the table behind the bakelite panel may be attached to a rubber tube for use with either the prone or erect apparatus. It is used for exerting pressure on relatively large areas of the stomach and colon, and is inflated from the operating booth under fluoroscopic control.

Exposures may be made either from the operating booth or from the room itself, in the latter case by using the hand switch hanging on the wall.

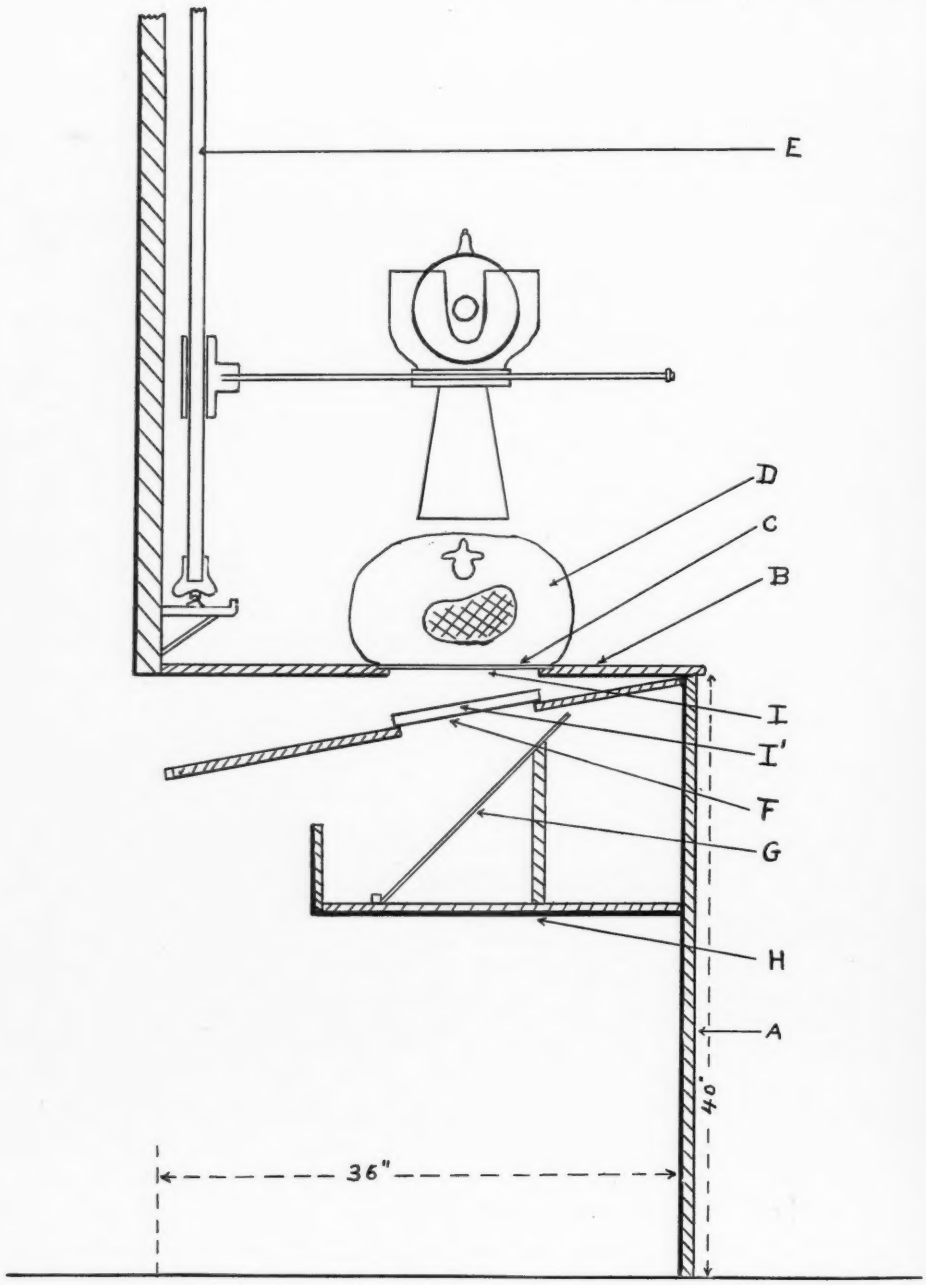


Fig. 10. Cross-sectional drawing of the serial table shown in Figure 9. *A*, a wooden box 40 inches high, 36 inches wide, and 7 feet long. *B*, wooden top of box. *C*, bakelite panel mounted in the top surface of the box. *D*, cross-section of patient in the prone posture. *E*, tube stand mounted on rail on the side wall. This mounting of the tube stand is optional, as one may also use a floor tube stand. *F*, fluoroscopic screen, surface down. *G*, mirror in which to view the fluoroscopic screen. *H*, lead-lined box to prevent secondary rays from hitting operator. *I*, intensifying screen, surface down. *I'*, intensifying screen, surface up. *I* and *I'* are for use with naked films when the booth is dark. Any standard cassette may be used in a lighted booth. Only one set of screens is necessary if the booth is dark, otherwise 6 or 8 cassettes with 12 or 16 screens are necessary. The same principle is used for the erect position, with the patient standing at the foot of the table.

The entire table and the exposed wall of the booth is lined with lead, which is indicated by the heavy black line in the drawing.

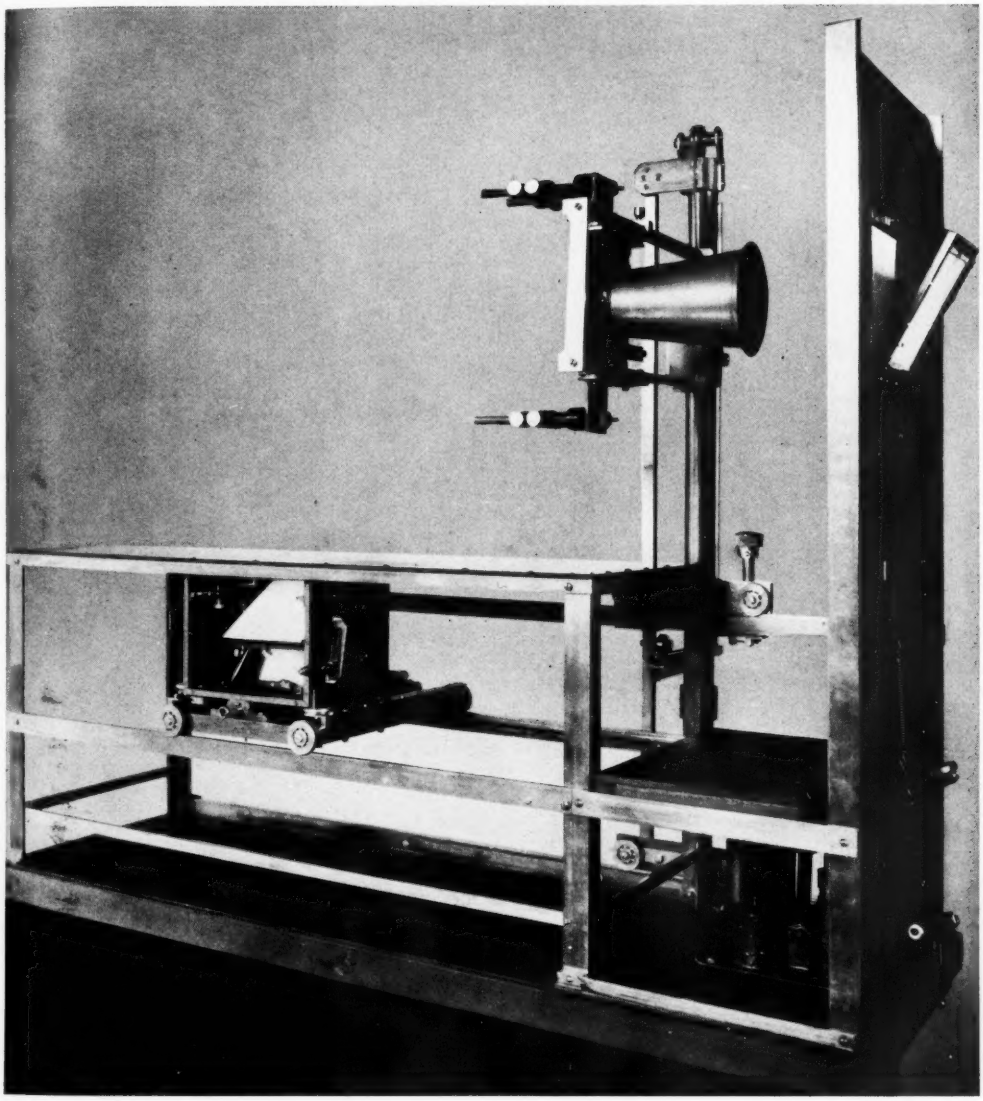


Fig. 11. Model of serial table designed and constructed by C. I. Headland, M.D. This table may be used as it is in a darkened room, or may be mounted as an integral part of the wall of an operator's dark room.

In the prone film-changing apparatus the movable hinged shelf which carries above, the lower intensifying screen, and, below, the fluoroscopic screen, is shown hanging down so that the intensifying screen is visible. Below this is the 45-degree angle mirror, and in the mirror one can see the reflected image of the fluoroscopic screen. This box may be interlocked with the tube stand so that the cone automatically is centered to the intensifying and fluoroscopic screens, when the apparatus is moved either up and down or across the table. Thus, by moving the tube stand and film-changing apparatus as a unit, one can localize and center the stomach without moving the patient.

For roentgenography in the erect posture the patient stands upon the platform at the end of the table, facing the lead-lined vertical panel. The platform is mounted on an hydraulic elevator, and the lowering and raising of the elevator is controlled by the two levers which pass through the vertical panel. The film-changing apparatus mounted in the vertical panel is a cassette, the back of which has been replaced by a bakelite cover on the front of which is mounted the back intensifying screen, and on the back of which is mounted the fluoroscopic screen covered with lead glass.

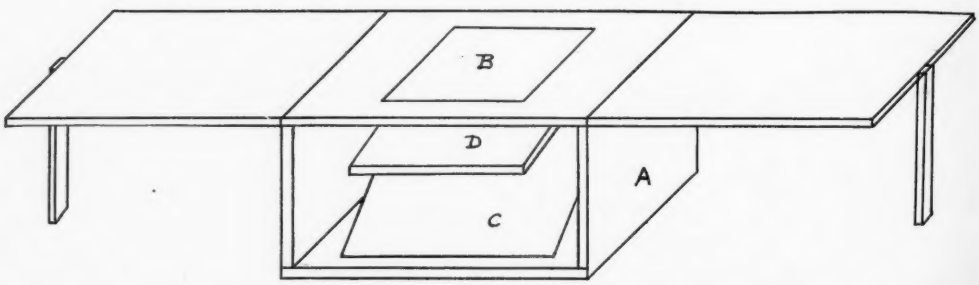


Fig. 12. Diagrammatic drawing of the simplest type of apparatus for serial roentgenography. This was primarily constructed and actually used at Base Hospital No. 1. *A*, a flat wooden box. *B*, a bakelite panel mounted in the top of the box. *C*, a mirror, set at an angle of 45 degrees, to reflect the fluoroscopic image. *D*, a wooden shelf attached by hinges to the back side of the box so that it is movable. A fluoroscopic screen is mounted on the under side of this shelf, the fluorescent surface facing the mirror. Cassettes are slid onto the top of the shelf, so that when the shelf is held up against the top, either by the hand or a locking device, the cassette is pressed firmly against the under surface of the bakelite panel. At both ends of the box are leaves of wood to support the patient's body. These leaves are not quite as long as the box and may be so hinged that when not in use the leaves may be folded back on the top of the box, and the entire apparatus may then be used as a step or stool.

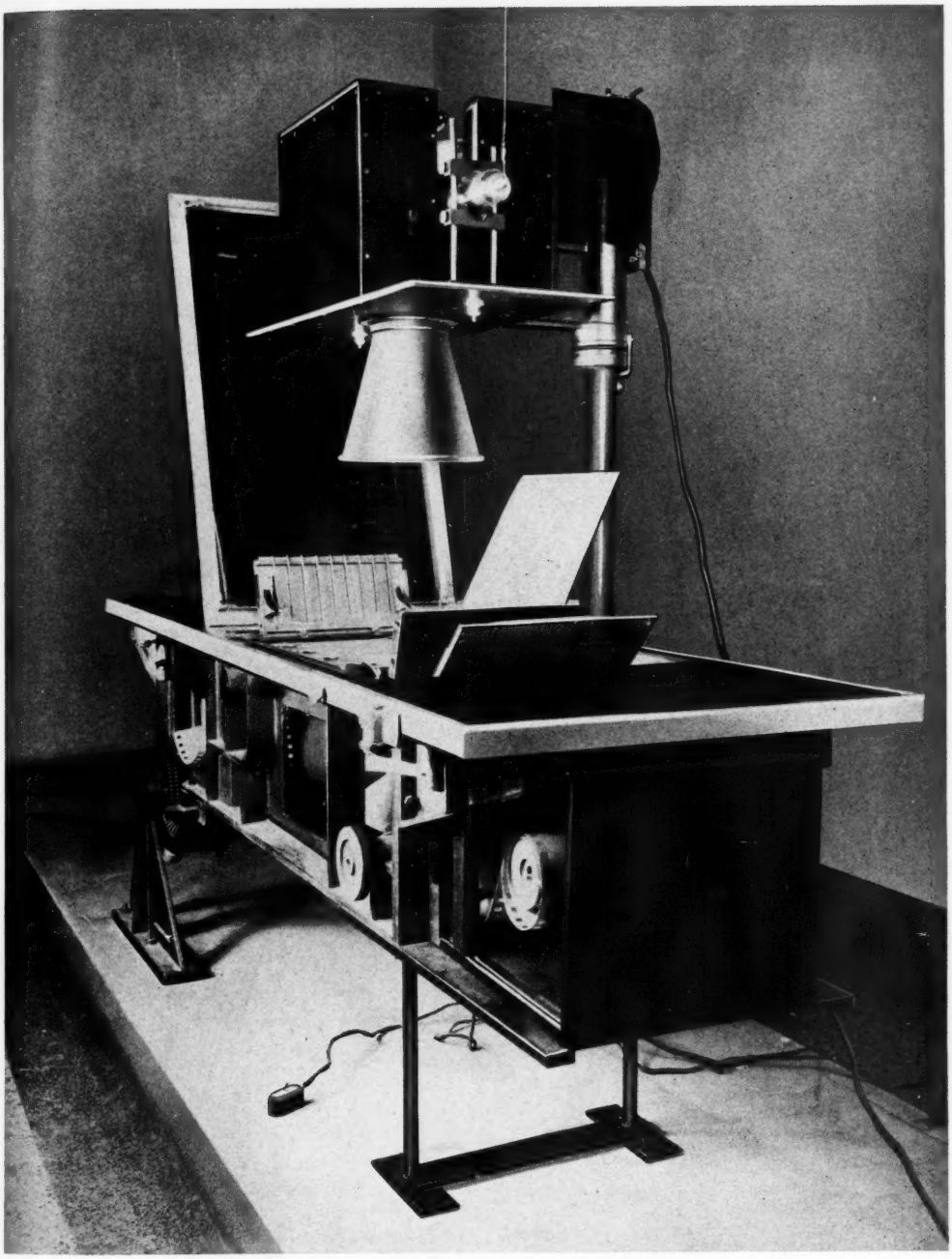


Fig. 13. A roentgenocinematographic apparatus designed to move a perforated film 10 inches wide in exactly the same manner that a standard motion picture camera moves a smaller film. This apparatus is installed in the Joseph Purcell Memorial Laboratory at the Fifth Avenue Hospital, New York City. With this apparatus we are able to make true motion pictures of the stomach and a short run of a roentgenocinematographic film is shown in Figure 15.

The unused film is contained in a magazine and is shown under the near end of the table. After passing around wheels with sprockets the film is threaded between intensifying screens and then through rollers back into another magazine at the far end of the table. In this photograph the apparatus is opened up for threading, and when the doors of the apparatus and the table top are closed it appears as is shown in Figure 14. A worm gear at the far end of the table enables it to be used in either the horizontal or vertical position or at any desired angle. The same reflecting mirror which has been employed on the serial tables, enables one to observe the action of the stomach both prior to the making of the film and during the time that the film is actually being exposed.

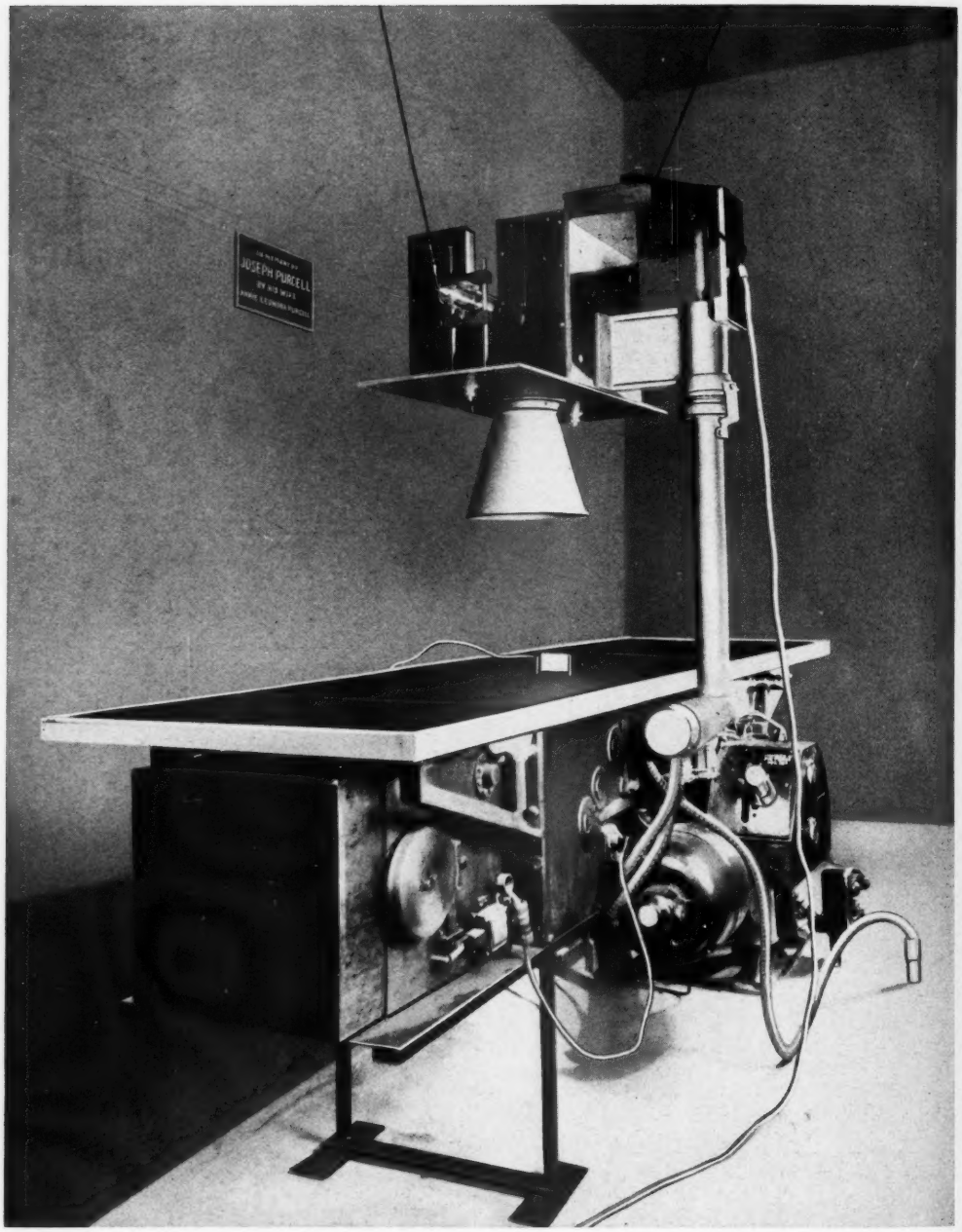


Fig. 14. The roentgenocinematographic apparatus closed and ready for action. The tube is enclosed in a ray-proof box. The timing of the exposures is accomplished by a switch at the top of the tube stand which may be used to break either the secondary or primary current. The motor which drives the mechanical parts is observed in the foreground, and just behind this is a speed-changing device similar in size and shape to a gear shift on an automobile, which enables us to make a continuous roentgenographic film at various rates of speed.

Fig. 15. Shows a short run of roentgenocinematographic film of the stomach made with the apparatus illustrated in Figures 13 and 14.

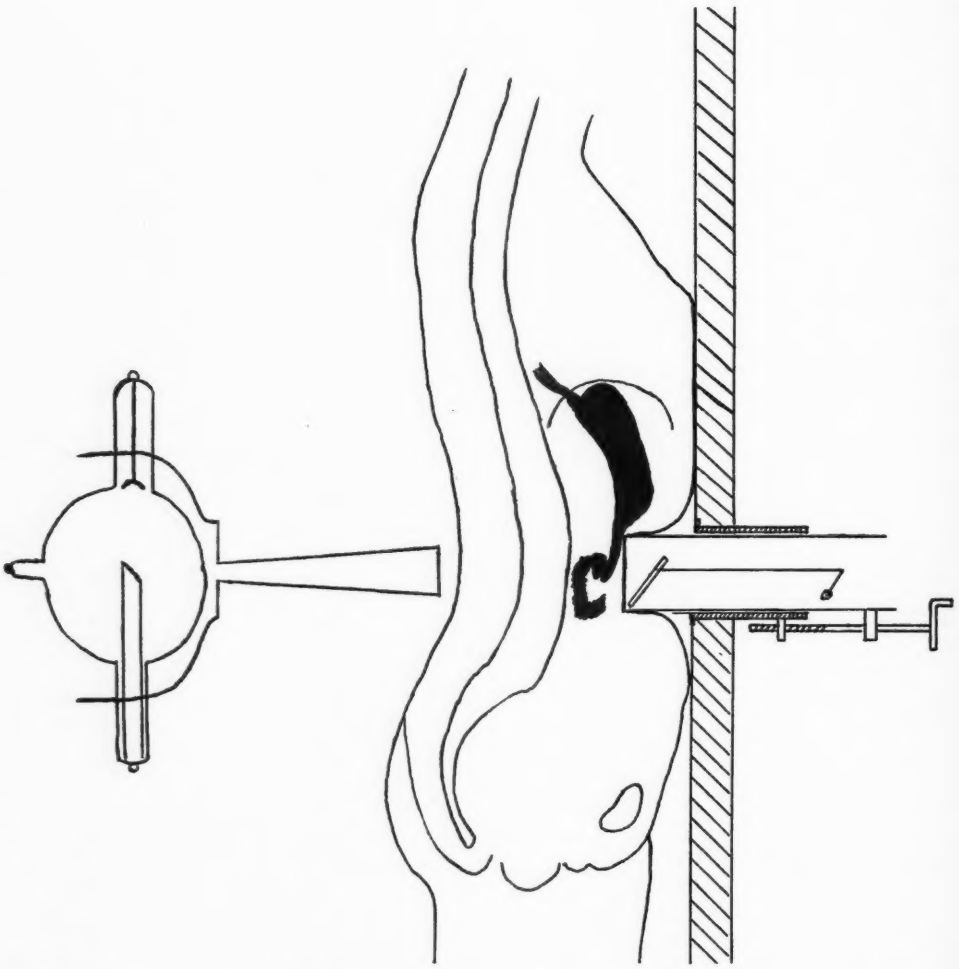


Fig. 16. Diagrammatic drawing showing the method of use of the compression apparatus designed and constructed by C. I. Headland, M.D. The patient is held against the face of the wall by the strap shown in Figure 9. This figure also shows the face of the apparatus protruding through the wall.

Compression is exerted on the soft, compressible abdomen by a rectangular piston which has rounded corners and is faced with a beveled layer of cork (third principle). The piston is pressed into the anterior abdominal wall by means of the screw gear. The intensifying screens and the fluoroscopic screen, mounted inside the front of the piston, are thus buried in the anterior abdominal wall and in extremely close contact with the opaque medium (fifth principle). No grid is used, the film being separated from the abdominal wall by only a thin intensifying screen and a thin layer of bakelite and cork. The gas tube is used which generates fewer secondary rays in the patient than any other tube (first principle). A cone is used which has the smallest diameter that will cover a 3¼ x 4 inch film at a 24-inch distance (second principle). The region to be examined is localized and the degree of compression desired is obtained under fluoroscopic examination. The image recorded in the roentgenogram is observed fluoroscopically at the instant of exposure.

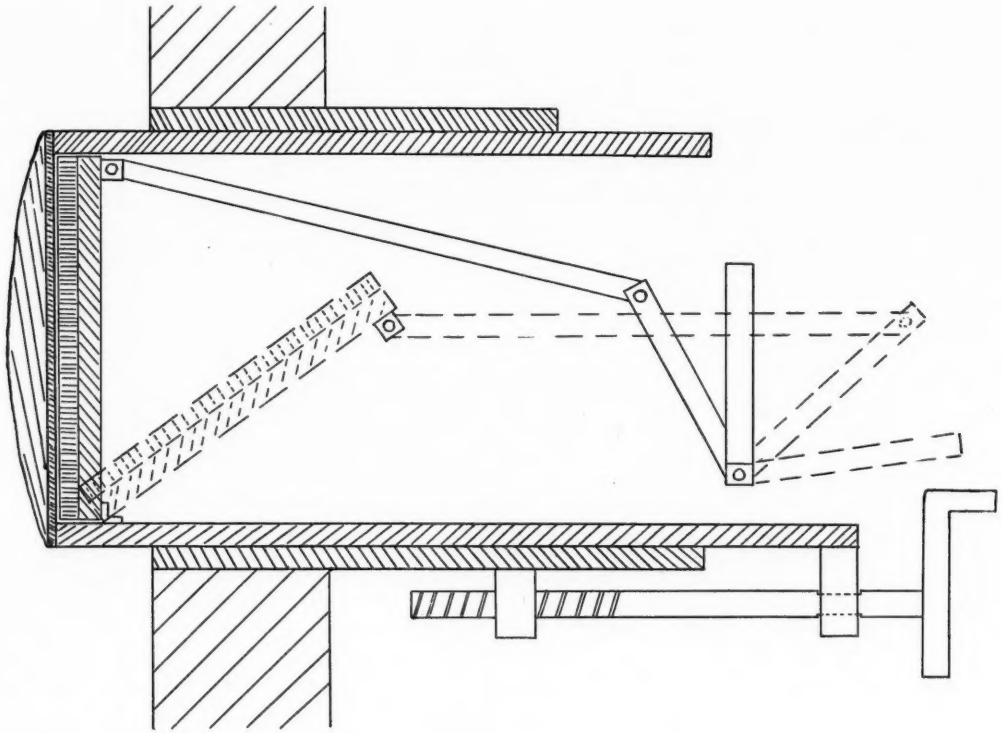


Fig. 17. Diagrammatic cross-sectional drawing showing the plan of construction of the compression device designed by C. I. Headland, M.D. The dotted lines show the position of the movable plate when drawn back for insertion or removal of the film. On this movable plate are mounted the back intensifying screen and the fluoroscopic screen.

Fig. 18. An enlargement of a 3¼ x 4 inch film similar to those shown in actual size in Figure 19. This is presented to show the detail and contrast as reproduced on the photo-engraving directly from the original film. This detail is obtained by using four out of the five fundamental principles for eliminating secondary radiation described in the text, namely, (1) gas tube, (2) small cone, (3) compression, (5) close apposition of the film to the part being examined. The fourth principle, the revolving grid, is not employed.

A, the cap, with criss-cross arrangement of the mucosal folds. *B*, pyloric valve. *C*, pyloric canal. *D*, antrum. *E*, descending duodenum. *F*, duodenojejunal flexure.

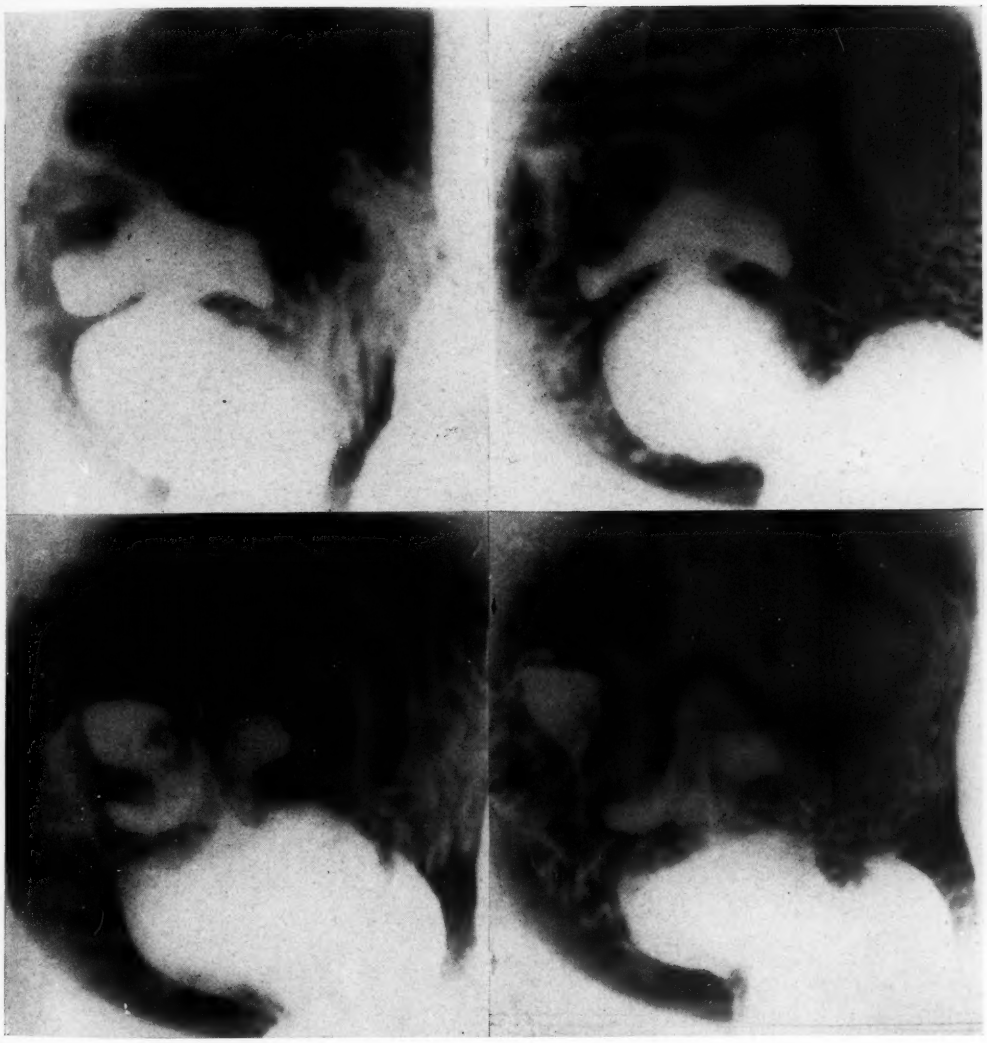


Fig. 19. Roentgenograms showing four stages of graduated pressure on the same cap. These are reproduced in actual size directly from the original films. A small ulcer on the posterior surface of the cap is shown distinctly, but it is not as characteristic as the crater deformity shown in the oblique films of the cap without pressure, which will be illustrated later when describing ulcers of the cap.

THE GAMMA RADIATION OF RADIO-ACTIVE SUBSTANCES

By JEAN THIBAUD, D.Sc., Director of X-ray Laboratory of School of Higher Studies, Faculty of Sciences, PARIS

Translation by HENRY BAYON, M.D., New Orleans, La.

GAMMA radiation is emitted by a considerable number of radio-active elements which bear a close relationship to X-rays. This very complex radiation constitutes a spectrum of lines, characteristic of the discharging radio-element, the wave lengths of which vary from 0.25 to 0.005 Ångström unit. This means that the gamma rays extend the territory of X-rays to high frequencies. Their energies expressed in volts can vary from 50,000 to over two millions.

The power of penetration of these radiations is, in general, far superior to that of X-rays. The effects of certain gamma rays are perceptible through 10, or even 20, cm. of lead. Thus, the coefficient of absorption in a lead screen is susceptible of falling to the value $\mu = 0.5$ cm. for the very hard gamma rays of Radium C. Moreover, it seems that the law of variation of absorption proportionate to the cube of the wave length (law of Bragg-Peirce) is equally true for gamma radiation.

In general, the X- and gamma-rays exhibit the same properties, modified in the latter, however, by the effect of the extreme shortness of the wave length.

Hence the scattering of the gamma rays in material substances includes both a classic effect (Thomson) without change of wave length and a Compton effect. The quantum of scattering in this instance assumes an importance which becomes more considerable as the frequency increases, and for radiations, the energy of which corresponds to more than a half-million volts, it is just about the only one observed.

The softest gamma rays exhibit very distinct diffractive effects in crystals, effects which have been utilized in the measurement of their wave length (Rutherford and Andrade, Frilley, Thibaud). The author has made use of the rotating crystal method and a spectrograph (Fig. 1), which shows the considerable development of the collimating slit system the length of which reaches 25 centimeters. Figure 2 represents the gamma spectrum of the radiothorium. On the right side the rays have energies which do not exceed the energy of X-rays. A weaker line is observed, equal to 0.052 Ångström unit, the quantum reaching 236,000 volts.

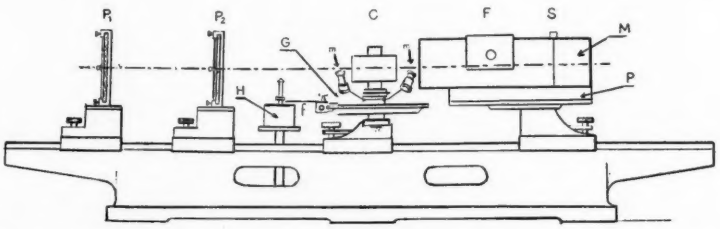


Fig. 1. Spectrogram by rotating crystal method for diffraction of gamma rays.

However, when the frequency rises, the angles of diffraction on usual crystals (rock salt d = 2.814 Å.) do not extend beyond a few tenths of minutes and measurements of

the wave lengths become altogether inaccurate. Moreover, the intensity of the lines weakens considerably, and the percentage of

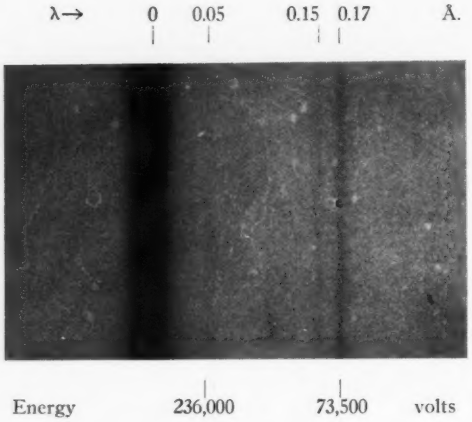


Fig. 2. Spectrum of gamma radiation of a radiothorium preparation (rotating crystal).

electromagnetic effect in the spherical coefficient of gamma-ray scattering diminishes rapidly when the quantum exceeds 200,000 volts.

On the contrary, the effect of Compton scattering is particularly clear-cut: the recoil electrons acquire considerable speed. Photographed in the Wilson chamber, their trajectories present a rectilinear course, at times exceeding a decimeter, which distinguishes them clearly from the recoil electrons produced by the impact of the X-rays (fish tracks), measuring, at most, a few millimeters. The biologic effects of hard gamma rays must be attributed to these secondary scattered electrons travelling through the irradiated tissues like minute arrows, disseminating in the cells the ions generated on their way.

The gamma rays coming in contact with the tissues give rise to abundant secondary radiations and, particularly, to an appreciable corpuscular radiation. The photo-electric effect presents here the same aspect as that of roentgen rays: the author has verified that for the different elements, from copper to uranium. The kinetic energy of the photo-electric corpuscles is equal to the gamma quantum of the exciting monochromatic gamma radiation, diminished by the energy involved in extraction from the K, L, etc., levels of the element considered (relation of Einstein). In other words, the kinetic energies of photo-electrons coming from the most penetrating gamma rays scarcely differ from the energy of the incident quanta. The experiment is very easily demonstrated by surrounding a tube of small diameter, containing the radio-active substance, by a layer of the element to be investigated, for example, a sheet of lead or platinum. The velocity spectrum of the photo-electrons generated by this secondary radiation is obtained in a magnetic apparatus, similar to the one in use for corpuscular spectra for X-rays, which allows the gathering, at the same point, on a photographic plate of all the secondary beta rays which have been issued from the radiator at the same speed (Fig. 3).

The comparison of beta spectra, registered with different radiations, shows a displacement of all homologous rays towards the greater velocities when the atomic number of the element decreases (Fig. 4). This fact explains the corresponding diminution in the processes of extraction, K or L, of atoms.

These observations have also demonstrated that the spectral lines of beta rays, spontaneously emitted by radio-active substances of gamma radiation, were due to the conversion of the latter in the electronic layers of the radio-active atom.

Examined in a very light element, such as gas, the photo-electrons are relatively scarce compared to recoil Compton electrons. It is known that the relation of the numbers of secondary electrons of each of these types represents, for the radiations of

high frequencies, the relation of coefficient of scattering σ and of absorption due to fluorescence in the radiating element. For example, the relation of the coefficients σ/τ passes from the value 0.27 to the value 32, when the wave length diminishes from 0.7 to 0.1 Ångström unit. It is evident that for gamma rays this ratio can assume high values and that the number of the recoil electrons observed in the Wilson apparatus in a gas is extremely high compared to the photo-electric electrons.

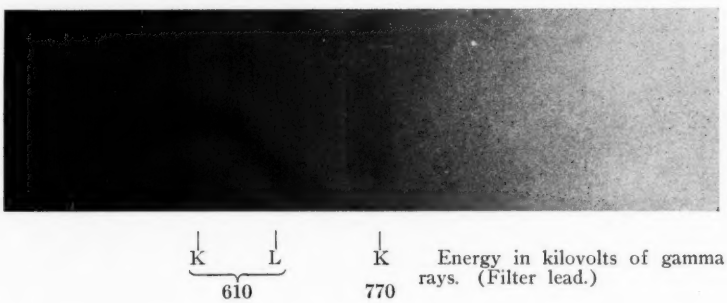


Fig. 3. Photo-electric effect of gamma rays of radium.

The measurement of the wave lengths of gamma rays by diffraction in crystals is limited, as we have seen, to the less penetrating of these radiations. The most general method consists in determining directly the frequencies, beginning from the photo-electric relation of Einstein, by transforming the gamma spectrum to be considered into secondary electrons in a radiator of well-known levels of energy. In this manner, Ellis and Thibaud have been able to demonstrate the great number of gamma spectral lines in different radio-elements of radium and thorium families. The quantum of some of these radiations exceeds the enormous energy of 2,000,000 volts (wave length 0.006 Ångström unit). It is probable that only the inadequacy of our measuring instruments actually imposes this limit and that there are radiations of still higher quanta.[1]

Differing from X-rays, gamma radiations emanate from much deeper atomic regions. Their origin must be attributed to energy exchanges generated in the very nucleus of the atom. Undoubtedly the study of such spectra will result in appreciable information regarding the dynamics of these still mysterious minute nuclei. Their complexity is certainly as great as that of the rest of the atomic structure. It already has been demonstrated in the absence of other guides that the principle of combination is applicable to different rays of the same spectrum. This translates the existence in the molecular domain of a subdivision in levels of energy or quantum states, repeating on a very much reduced scale the succession of electronic layers of Bohr.

Finally it seems logical to include in the category of gamma rays these extremely penetrating radiations of cosmic origin, which (for the present) are the end of the spectrum of known, very high frequency radiations. Their existence has just been definitely proved (Millikan, Kohlhorster). These cosmic, or ultra-gamma, rays to which is due the increasing ionization ob-

[1]Cosmic rays: ultra-gamma. There are also beta rays of 10,000,000 volts.

served progressively ascending in the atmosphere, could not be totally absorbed except in considerable material densities; for example, 23 meters of water or, again, 20 meters of lead. It is difficult to evaluate the quantum of such radiations: possibly it would reach 20,000,000 or 30,000,000 volts. Their origin can be sought in the profound transformations of atoms of celestial bodies (nebulæ) in which conditions of temperature and pressure are very different from those of the terrestrial globe.

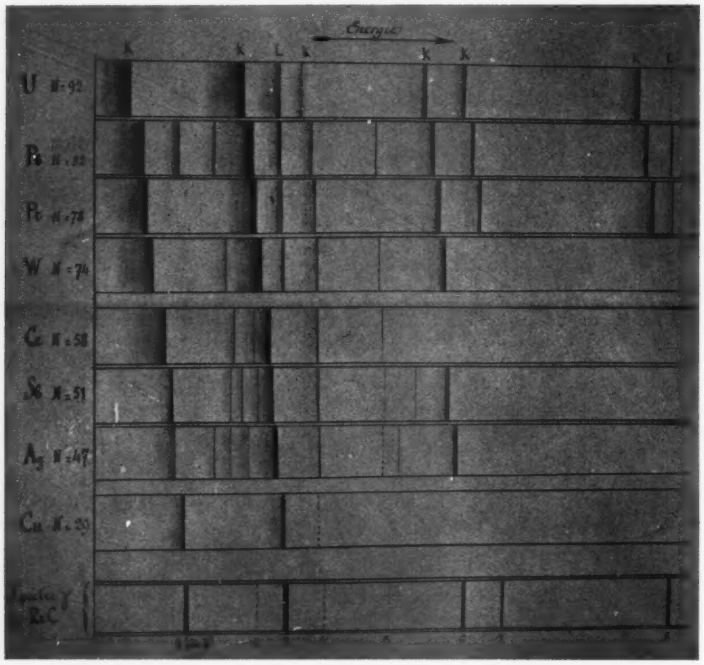


Fig. 4. Photo-electric β spectra produced by gamma rays of radium.

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APPLICATION OF ROENTGEN RADIATION TO THE BARIUM-FILLED STOMACH

A CONTRIBUTION TO THE RADIATION TREATMENT OF INOPERABLE GASTRIC TUMORS

By THOMAS SCHOLZ, M.D., New York

THE most disappointing phase in the roentgen-ray treatment of malignant tumors has been the radiation results in inoperable gastric tumors. No matter what apparatus has been used and no matter what technic has been employed, the results, even in the most experienced hands, apparently have been not only uniformly negative, but in some instances the treatment has seemed to hasten the fatal course.

In view of such results it is no wonder that at the present time the consensus of opinion of roentgen therapeutists of wide experience does not favor radiation in inoperable gastric carcinoma. Pfahler (1) says:

> In general, the intestine and the abdominal tissues will not stand the amount of irradiation necessary to destroy carcinoma of the stomach. We must obtain some addition to our present methods in order to accomplish such results. There is some hope in this direction.

Levin (2) declares:

> In my experience, high voltage X-ray therapy in carcinoma of the stomach has its value only as a post-operative measure, *i.e.*, after the main tumor mass is removed surgically or else destroyed to a large extent by intramural radium insertion.
>
> High voltage therapy, as well as surface or distance applications of radium in cases of advanced inoperable carcinoma of the stomach, has not given any satisfactory results as a general rule, though I did have a very limited number of cases in which there seems to have been a temporary improvement.
>
> It frequently happens in my experience that a high voltage course either creates a cachexia or enhances the previously existent cachexia. In view of all this I do not favor high voltage therapy as the only therapeutic measure in carcinoma of the stomach.

Wood (3) is of the opinion that "carcinoma of the stomach cannot be favorably affected by treatment with either type of radiation." And more recently (4) he states:

> I regret to say that I have never obtained results of any importance in irradiating carcinoma of the stomach. As a rule the patients are made more uncomfortable and I have abandoned treating such patients.

Forssell (5) in a recent article reviewing the irradiation results obtained in the Radiumhemmet at Stockholm makes no specific mention of gastric carcinoma. In Table IX of his article he classifies gastric carcinoma among that group of lesions in which surgery is the only applicable method of treatment.

My own experience in the treatment of gastric tumors dates back to the year 1915. From that time until the end of 1919 I treated with medium voltage rays, in the Lebanon Hospital and in private practice, altogether seven cases of inoperable gastric cancer without any appreciable results. Two of these patients, who were of advanced age and in whom gastro-enterostomy had been performed, died within 21 and 27 months, respectively, after the operation, while the remaining five younger patients, in whom only exploratory laparotomy had been done, succumbed within from two to nine months.

From 1920 until the end of 1922 I treated with high voltage rays six cases of inoperable gastric carcinoma. The results obtained

were, contrary to enthusiastic expectations, extremely disappointing. Radiation sickness became, in these cases, a more disturbing factor than before. In some instances it appeared as if the fatal course was hastened by treatment.

Of especial interest in this series was a case referred to me by Dr. Max Einhorn. The patient, a man 56 years of age, presented at the operation (performed by Dr. Willy Meyer) a large adenocarcinoma involving the middle third of the greater gastric curvature. A few days after application of a 115 per cent S.E.D. there appeared a brown discoloration of the body involving even those parts which had been protected by a heavy lead material. The discoloration gradually increased within the next two weeks and was associated with a very rapid decline of the patient's condition, followed by exitus five weeks after the operation.

This and other similarly disastrous results induced me at the end of 1922 entirely to abandon X-ray treatment for gastric carcinoma.

In 1923 there appeared an article by Holfelder (6) in which he, too, mentioned the uniformly disappointing radiation results in gastric carcinoma. At the same time, however, he pointed out that these poor results probably were due to an injury to the adrenals caused by the usual treatment technic. Experiments on guinea pigs had shown that the suprarenal glands cannot tolerate more than a 60 per cent skin erythema dose. In gastric carcinoma, therefore, he suggested the application of the rays at such an angle that the adrenals, or at least one of them, might completely be avoided. And in a later publication (7) he reported that with such a technic they have accomplished in gastric carcinoma "at least some results, while previously we have had nothing but disappointments."

MODIFICATION OF RADIATION METHOD

Holfelder's article gave food for new thought which gradually led to certain modifications of the technic in the radiation treatment of gastric tumors.

Taking it for granted that avoidance of the adrenals was essential for any successful radiation treatment in gastric tumors, it became evident that a reliable method for a definite localization of these glands in each individual case, would be of paramount importance. A few experiments with this objective indicated that the best way of accomplishing it would be by projecting in each instance the position of the adrenals and of the stomach upon the surface of the body. The position of the suprarenal glands could best be ascertained with the aid of a roentgenogram of the kidneys. By marking the position of the plate upon the patient's body before the exposure, one may transfer by means of a tracing of the plate findings the position of the kidneys upon the body surface. The outline of the stomach is marked upon the patient's abdomen directly by means of a contrast meal and fluoroscopy. Having thus obtained in visible form the exact location of kidneys and stomach and, therefore, also that of the adrenals and gastric tumor, one may easily succeed in arranging the direction of the rays so that at least one suprarenal gland may be definitely avoided.

During these experiments there also occurred the idea that it might be of value to increase the local X-ray effect in cases of gastric tumors by applying the radiation to the barium-filled stomach. As barium has a larger absorption coefficient than the tumor mass, there would therefore be produced in the barium-filled stomach a greater intensity of secondary radiation and a greater effect would be felt upon the adjacent tumor. This would possibly eliminate the necessity of high voltage rays and thus

increase the safety for the adrenals and also for the pancreas. Besides, the barium-filled stomach would in many instances almost completely protect the left suprarenal gland.

After deliberation it was decided at the beginning of 1924 again to take up X-ray treatment of inoperable gastric tumors, using the method just outlined, namely, surface localization of the adrenals and gastric tumor, selection of such a direction of the rays as to assure best possible avoidance of the adrenals, medium voltage rays, and application of the radiation to the barium-filled stomach. It was taken for granted that of the two types of secondary rays it would be the "characteristic" radiation which would mainly contribute to the increase of the local radiation effect. By very cautiously progressing with the dosage, it was hoped gradually to obtain a fair idea as to the therapeutic effect of the technic even without any previous experiments on the intensity of the secondary radiation.

The first case of "inoperable carcinoma" of the stomach treated with the above method was a patient in whom a gastro-enterostomy had been done. The patient is now, more than seven years later, in perfect health. Roentgen-anatomically the tumor mass has undergone a complete regression. However, as no microscopic findings were available, the case is published without any claims as to the nature of the lesion. The report, therefore, will be confined to clinical and roentgenologic facts.

REPORT OF CASE

History.—Mr. A. P., 68 years of age, married, roofer by profession, always enjoyed good health prior to his present trouble. He drank beer and wine moderately, whisky very rarely, and did not smoke. Being of medium height, his weight normally used to vary between 156 and 160 pounds.

He ascribed the present complaint to a severe injury to the abdomen sustained approximately two years previous to the examination. Local symptoms of that trauma disappeared within a few days. Nine months later, however, he began to experience an occasional "pain in the stomach," which had no relation to meals. He made no concessions to it, however, and continued his daily work.

After about five months he noticed a gradual loss of strength and weight, together with an increase in the frequency of the attacks of gastric pain which now seemed to become aggravated by food; however, his appetite still was good.

The following seven to eight months were characterized by intermittent periods of indigestion. In the meanwhile he had become accustomed to being "careful as to his food," and to restricting the amount of his daily work.

Approximately two months before the operation, he began to lose weight and strength more rapidly, the gastric pain became almost constant, appetite diminished, and constipation set in. He then decided to consult a physician.

Physical Examination.—On palpation there was a moderately large, markedly tender, mass in the gastric region. Otherwise the examination was negative except for the suggestion of marked recent loss of weight (the patient now weighed 125 pounds) and an apparently greatly weakened general condition.

Laboratory Findings.—Roentgen-ray examination showed "definite evidence of a neoplasm involving the pyloric third of the stomach, associated with very pronounced 6-hour gastric retention" (Fig. 1). Free HCl was present, though markedly diminished. There was occult blood in the feces. The blood picture was that of secondary anemia. The Wassermann test and urinalysis were negative.

A diagnosis of pyloric carcinoma was

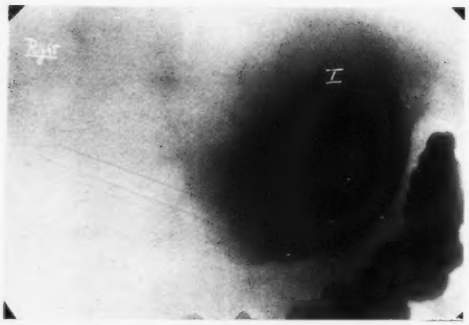

Fig. 1. Appearance of the stomach before operation showing almost complete obliteration of the pyloric third of the stomach outline.

made by Dr. Max Krueger, the attending physician, and two gastro-enterologists. Immediate operation was advised.

Surgical Findings.—Operation was performed on March 27, 1924, by Dr. Alfred H. Thomas, at the Staten Island Hospital. A tumor mass was found involving the pyloric third of the stomach, associated with marked and extensive enlargement of the regional glands. "The appearance of the tumor mass," Dr. Thomas stated, "had all the characteristics of a large cancer, impossible to remove." A gastro-enterostomy was done. No tissue was removed for histologic examination.

The patient was referred for radiation treatment on April 24, five weeks after the operation. There was, at that time, a moderately tender, palpable mass in the mid-gastric region. He complained of slight oppression and pain after meals. His weight was now 121 pounds.

RADIATION METHOD AND ITS EFFECT

First, a projection of the renal and adrenal outlines upon the patient's abdomen and back was obtained in the manner described above. The patient then was given a barium meal. The stomach could hold only one-half of a glass of the contrast mixture. The plate findings as shown in Figure 2 are self-evident. The patient afterward was placed on a fluoroscopic table and the outline of the stomach was marked on the abdominal surface. The gastro-enterostomy stoma was found to be working well.

From the gastric and adrenal outlines thus obtained, it was evident that two portals of entrance—anteroposterior, with a slight tilt caudalward, and left lateral—would assure avoidance of the suprarenal glands in this case. In estimating the radiation dose to be applied it was deemed advisable to observe the rule of *nil nocere,* in view of the unknown factor of secondary rays produced by the barium-filled stomach. After considering all the various factors (which will be discussed more elaborately in a special paper), the following was decided upon: mechanical rectifier, 145 K.V. peak, 5 mm. filter, 50 cm. distance, dose, 350 r.

The dose was repeated after four weeks and was again repeated five times at intervals of three weeks. Finding no reaction of any kind which could be attributed to the radiation treatment, five more applications under practically the same technical conditions were given at intervals of two weeks followed by a rest period of three weeks. When again no local reaction appeared, the roentgenologic appearance of the stomach remaining the same, though there was definite clinical improvement, the intervals between the radiation treatments were cut down to one week.

A few days after the third of these treatments, the patient began to complain of "pain in the stomach with a feeling of soreness," markedly aggravated by food. On palpation there was found very pronounced local tenderness, and, on fluoroscopic examination, very great gastric spasticity. The roentgen treatments were interrupted, the patient being put to bed and placed for three weeks on a fluid diet.

In the course of approximately two months, the acute symptoms gradually dis-

appeared. There still remained a palpable mass, moderately tender to touch, and occasional feeling of oppression and pain after meals. Roentgen-anatomical evidence, however, seemed now to indicate beginning regression of the tumor along its proximal periphery.

Fig. 2. Appearance of the stomach after operation and at the beginning of the radiation treatment.

The radiation treatment was taken up once more, the dose described above being applied every two weeks. After the fourth treatment, there again appeared moderately marked permanent gastric pain. The treatments were discontinued and within four weeks the pain again disappeared. Roentgenograms now revealed more definite evidence of a recession of the tumor mass.

On the strength of the experience gained so far, the treatments during the following years, until the end of the fifth year, were given in the form of four series each year. Each series consisted of three treatments at intervals of two weeks. Two such series were applied during the first part of the year, being separated by a longer interval, and the other two series were given during the last part of each year. No treatments were applied during the months of June, July, and August. A final two treatments were administered during the first half of the sixth year, approximately one and one-half years ago.

The roentgenographic appearance of the stomach was watched by frequent X-ray examinations. Following the first slight suggestion of roentgen-anatomic improvement, found approximately one year after beginning of the treatment, the regression of the tumor became more definite during the succeeding months. It continued steadily until, at the end of the fifth year, there appeared, roentgenographically, to be a normal stomach (Figs. 3, 4, 5).

The improvement in the general subjective condition of the patient was more rapid. He considered himself perfectly healthy at the end of the third year. Gastric pain disappeared within two years, palpable tumor within three years, and tenderness on

palpation within four years. At the present time, more than seven years after the operation, the patient is in excellent health, is of normal weight, and is able to do an amount of work which may be considered normal for his age, 75 years.

Fig. 3. Appearance of the stomach after two years of roentgen-ray treatment.

COMMENT

For a correct evaluation of the case just reported, various points have to be taken into consideration.

In view of the lack of microscopic findings, one cannot, of course, definitely consider the lesion one of gastric carcinoma. However, its characteristic clinical course, its macroscopic appearance as observed by an experienced surgeon, and the extensive involvement of the gastric and mesenteric lymph nodes make it more than probable that the condition was of a malignant type.

As to the therapeutic result, there is no doubt but that clinically a cure has been accomplished and that roentgen-anatomically the tumor mass had undergone a complete regression. Where there previously had been a solid tumor almost entirely obliterating the pyloric third of the gastric cavity, the latter was gradually re-established by the recession of the lesion to such an extent that, roentgenographically, there finally was obtained normal pliability and peristalsis of the entire gastric wall.

As to the causes for these gratifying results, all those factors ought to be taken into consideration which might possibly have contributed to them.

First, the patient's age was a favorable factor, because it is a well-known fact that, with advancing age, the malignancy of cancer as a rule decreases, while at the same time the tendency towards regression increases.

Secondly, spontaneous regression in carcinoma, as pointed out by Lohmer (8), Rohdenburg (9), and Trinkler (10), may have played an important rôle in this case, too. This point is of greater importance than is generally realized. A careful study

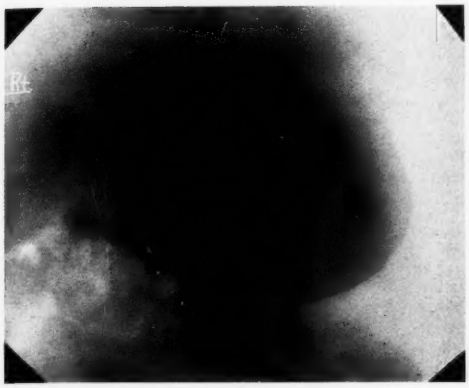

Fig. 4. Appearance of the stomach four years after beginning the X-ray treatment.

Fig. 5. Appearance of the stomach at the end of the fifth year.

of the instances of spontaneous cancer cures reviewed by the above authors definitely shows that the human body is not absolutely helpless against the carcinomatous growth. On the contrary, there seem to be factors, not properly understood yet, which apparently aid in or give the first stimulus for the regressive process. A more thorough study of these conditions will go far toward a proper understanding of the cancer problem. Such a study may prove of especial value in gastric tumors, because, as Ewing (11) has pointed out, and systematic X-ray examinations have shown, gastric cancer, more than any other cancer, is characterized by an intermittent growth. There often are long periods during which the growth remains stationary. Factors aiding regression brought into play during such stationary periods may become invaluable.

That gastro-enterostomy in inoperable gastric cancer occasionally is followed by a remarkable improvement, sometimes bordering on a complete cure, is a well-known fact. During my own observations, over a period of more than 20 years, in a large number of cases of carcinoma of the stomach, especially among the extensive material of the Montefiore Home, I have seen such patients remain alive, for a long time almost symptomless, as much as from three to five years after the operation. This would tend to support the theory of chronic irritation, because there is no doubt but that a gastro-enterostomy, especially in obstructive pyloric carcinoma, greatly relieves the irritating factor. We would have to admit, therefore, that in our case, too, the gastro-enterostomy may have played an important rôle.

The general medical care and handling of the patient has, of course, a great influence upon the therapeutic outcome. General measures for the purpose of strengthening the patient's vitality and increasing his power of resistance along the lines recently suggested by Jackson and Minot (12) are extremely helpful. Ease of digestibility and elimination of irritation possibly arising from certain articles of food should be important guiding factors in the selection of the diet. Conditions in this respect were, in our instance, fortunately ideal.

Finally, in regard to the X-ray treatment, there is no doubt but that it has played a rôle

in the therapeutic accomplishment. This is demonstrated by the fact that the regression set in only after an apparently sufficient amount of radiation had been applied. Furthermore, that the "characteristic" secondary rays probably were of decisive importance is suggested by roentgen-anatomic evidence to the effect that the regression started along the proximal periphery of the tumor and then gradually progressed towards the pylorus. In other words, the regressive process always was taking place along the contact line between tumor and barium. Besides, this radiation method has so far been used in five additional cases with apparently encouraging results. The dose, however, has since been slightly modified.

It would lead too far afield here to touch upon all the problems involved in the radiation treatment of the barium-filled stomach. A more detailed discussion of them will be published after the completion of certain experiments which are being carried on in collaboration with Dr. Arthur Mutscheller. Besides barium sulphate, bismuth-subcarbonate was used as a contrast medium. Experiments also were made with mixtures consisting of barium or bismuth, and other metallic powders, in an attempt to ascertain the best possible type of fluorescent radiation. In this respect, magnesium oxide, in its heavy and light forms, and calcium, seemed to give favorable results.

CONCLUSIONS

1. Roentgen radiation applied to the barium-filled stomach in inoperable gastric tumors seems to aid in the bringing on of the regression of the tumor mass.

2. Avoidance of the adrenals in the application of radiation to the stomach is of great importance.

3. The best way to avoid the adrenals is by definitely determining in each individual case the exact position of the suprarenal glands and of the stomach. This can be readily accomplished by projecting the outline of these organs upon the surface of the body.

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ON INTRATHORACIC LOCALIZATIONS BY STEREOROENTGENOGRAPHY, WITH A CONSIDERATION OF THE SOURCES OF ERROR

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IT has been observed by many working in roentgenology that stereoscopic radiographs commonly produce effects that are obviously faulty and illusory. We frequently encountered such troubles during the course of some recent work on the exact localization of cavities in patients with pulmonary tuberculosis, which involved the study of stereoscopic radiographs (1). In this work, mensuration was attempted on 250 pairs of stereoscopic radiographs, but 14 were found to have such pronounced distortion that a good deal of the contents of the thoracic cage was projected beyond its confines. This represents about 5 per cent of the total number, and we believe that it is a fair average for routine institutional work. It should be explicitly stated that very pronounced distortion existed in these 14; there were, of course, many more that were not rejected or even detected because of only very slight distortions. So far as we are aware, no analysis or explanation of such phenomena has ever been made. The problem seems to be of sufficient importance to merit such attention, inasmuch as stereoscopic X-ray examinations are among the most valuable aids in this branch of medical diagnosis.

The discovery of discrete pulmonary lesions that appeared to be outside the bony thorax when viewed stereoscopically led us to make observations on the other structures shown in these stereoscopic views. It was found that either one or more of the following conditions existed:

1. The ribs had shifted more than usual.
2. The width of the chest had altered.
3. The domes of the diaphragm had shifted anomalously.

These are all caused by the patient making respiratory movements between exposures, the most common cause being diaphragmatic breathing. Independent of the respiratory movements, and perhaps more common, but less marked, are disturbances which are caused by the heart beat.

A brief review of the principles involved are given for the sake of clarity. Stereoscopic observation is an attempt to reproduce normal vision by means of a pair of photographs so that normal plasticity will be revealed. It is a well known physiologic and psychologic fact that a realization of the third dimension in stereoscopic vision is largely a matter of education and experience. The realization of plasticity, or the judgment of depth, by one person may be more accurate than by another; the relations of objects to one another, regardless of the observer, however, will be proportional, so that correct ratios will be the same in the case of two observers. There is no established usage for the exposure of the two films of a stereoscopic pair, and the distances used for the target-film distance and tube shift are so different in the various laboratories that each worker forms his estimates from the sort of usage to which he is accustomed. The distance between the eyes is very nearly the same in all observers, and, accordingly, our judgment of distance in naked-eye vision is always based on the same

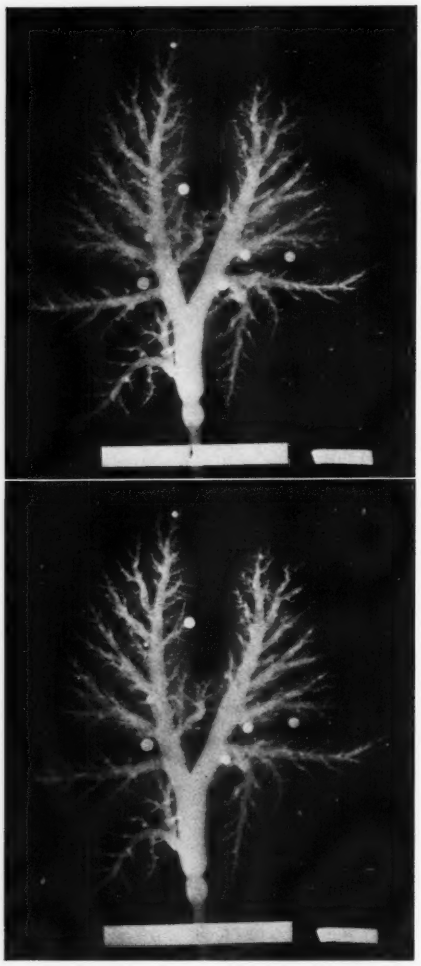

Fig. 1. Photograph of a pair of normal stereoscopic radiographs of a hog's lung, containing lead pellets, and injected with dental cement, reduced for viewing in a hand stereoscope.

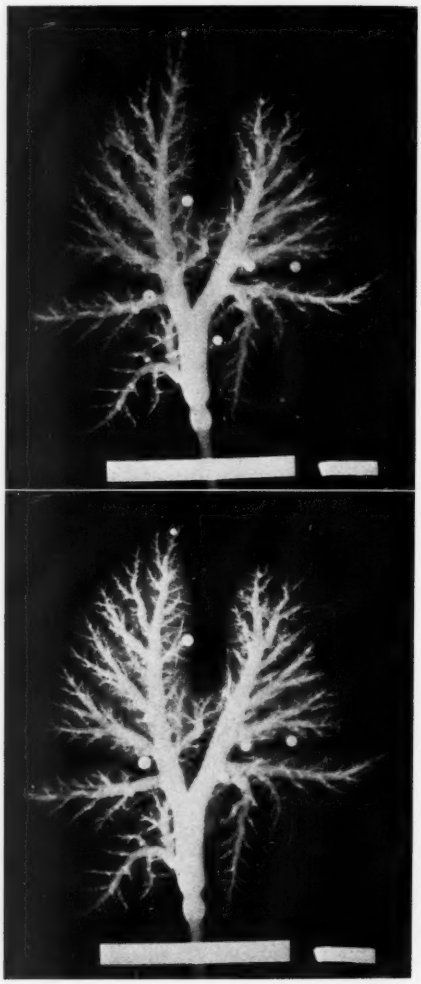

Fig. 2. Same as Figure 1 except that traction was put on the lower lobe at Pellet No. 1, and the tip was pulled down 2 cm., resulting in marked distortions.

distance apart on the datum line, which, of course, is not the condition in X-ray stereoscopy. This phase of the subject has been ably discussed by Stephenson (2). It was Helmholtz (3) who first thoroughly explained the physiology of binocular vision, showing that the viewing of an object from two slightly different angles will give it plasticity. Elihu Thomson (4) was the first, in 1896, to attempt the application of stereoscopic vision to X-ray work. He was followed by Davidson (5) in 1897, who successfully utilized the now familiar Wheatstone reflecting stereoscope and, incidentally, pointed out the distortion which is caused by motion between exposures. Also, his method for the localization of foreign bodies has been a model for many others.

The type of distortion depends on the direction and extent of the motion; for ex-

ample, the normally resulting stereoscopic shift is exaggerated on the radiographs when the tube shift is downward (which is the universal practice) and the diaphragm motion between exposures is upward, as is the case when the patient exhales. In this event the contents of the thorax will appear to be abnormally posterior, or nearer to, the observer. In extreme cases the bases of the lungs will appear outside the posterior ribs.

On the other hand, if the diaphragm moves downward (inhalation), the contents of the thorax will appear to recede from the observer and to be displaced anteriorly in the patient. This tends to annul the normal stereoscopic shift, resulting in a loss of depth. If the normal stereoscopic shift is just annulled, the object viewed will appear to be in the plane of the film, which is anterior to the chest. Furthermore, if the downward motion of the diaphragm causes a greater shift than the normal stereoscopic shift, the object will appear far anterior to the patient's thoracic cage.

In a similar manner, the movements of the heart will cause a distortion of the heart shadow and adjacent lung tissue, unless the exposure happens to be at exactly the same phase of the heart cycle. Such cardiac movements, however, are in no way related to the movement of the bony framework of the chest or the diaphragm, and may be in any direction instead of parallel to the shift.

In the examination of a pair of stereoscopic radiographs of the chest, therefore, there are several preliminary scrutinizing observations that should be made. First, one should see that all lateral dimensions of the bony framework are identical; that is, the distance between the scapulæ, the overall width between any pair of ribs, or the lateral distance of any object to the ribs, or midline, should be exactly the same on both. This is usually not true if respiratory movements of any kind have taken place.

EXPERIMENTAL

After rather extensive experimentation, we were able to prove the above-mentioned theory by a simple experiment. First, we used hogs' lungs in such a way that the various measurements could be obtained absolutely as well as geometrically and stereoscopically, and, second, we were able to apply this information to a practical problem on a patient who had a disseminated, partially healed, small, nodular pulmonary tuberculosis.

Experiment 1.—In a hog's lung (fresh) the bronchial tree was filled with an "artificial stone."[1] This was placed over an improvised tunnel for the X-ray film holder, on

[1]This product is a slow-setting dental cement.

TABLE I.—MEASUREMENT OF PELLETS IN HOG'S LUNG

Pellet number	Estimated	Calculated			Measured			% ± error between calculated and corrected measure
	Stereoscopic observation	2-in. shift	4-in. shift	Average	Distance	Correction	Corrected value	
1	2.2	2.0	2.0	2.0	2.5	0.2 + 0.4 = 0.6	1.9	−5.0
2	4.4	5.6	5.4	5.5	6.2	0.1 + 0.4 = 0.5	5.7	+4.0
3	8.8	9.0	8.6	8.8	9.6	0.4 + 0.4 = 0.8	8.8	0.0
4	9.7	10.0	9.2	9.6	12.0	0.5 + 0.4 = 0.9	11.1	+15.0
5	0.0	0.4	0.6	0.5	0.8	0.4 + 0.4 = 0.8	0.0	0.0
6	5.9	5.6	5.4	5.5	6.5	0.4 + 0.4 = 0.8	5.7	+4.0
7	0.0	0.0	0.5	0.3	0.8	0.4 + 0.4 = 0.8	0.0	0.0
8	33.2	0.0	31.2		0.0		0.0	0.0

top of four halves of pasteboard microscopic slide boxes one inch deep; a number of lead pellets were placed at different levels throughout the lung and directly over the film. One pellet was suspended above the top surface by means of cross-threads. The distance of each above the film was measured, and then stereoscopic radiographs were made, using a 40-inch focus-film distance, and four- and two-inch tube shifts, respectively. The measurements and calculations are tabulated in Table I. The estimated distance by stereoscopic observation is in Column 2; the distances calculated by measuring the shifts are compared in Columns 3 and 4, with an average in Column 5. The actual distances according to measurement are in Column 6, with corrections in Column 7, and the corrected values in Column 8. The correction is due to two things: first, the sag in the top of the X-ray table, which was actually about 4 mm., and, second, the half diameter of all the pellets, because the measurements were made from their tops and not the equatorial plane which casts the shadow.

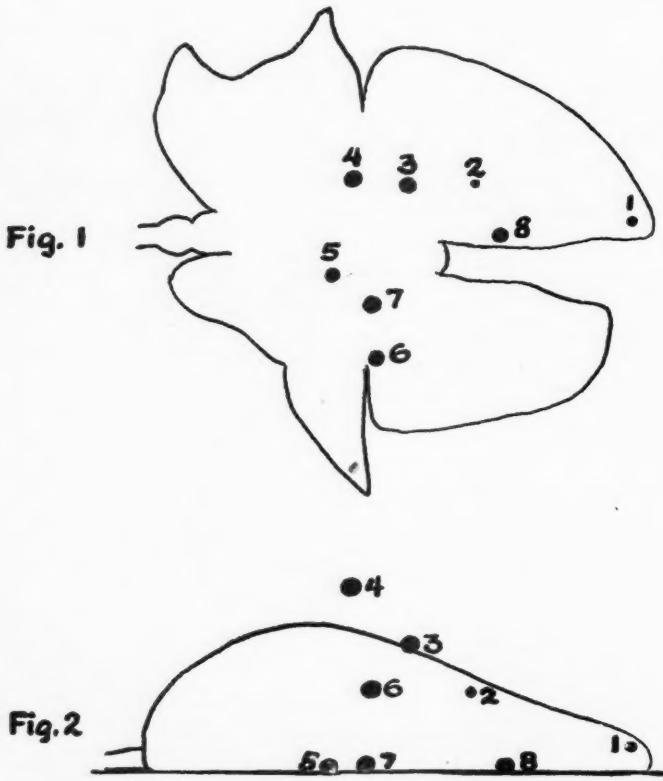

Chart I. Diagrammatic sketches of Figure 1, showing the positions of the lead pellets. Fig. 1, anteroposterior view; Fig. 2, lateral view.

Pellet No. 4 was suspended by cross-threads above the whole lung specimen, but no doubt was moved in shifting, as a movement of only 1.5 mm. would account for the discrepancy between the shift value and the actual measurement. The position of Pellet

No. 8 is purely illusory. It was simply rolled along the film parallel to the shift, and appears far out toward the observer. These conditions are shown in Figure 1, which is so arranged that it may be viewed with a hand stereoscope. Chart I is a diagrammatic sketch, to show the anterior-posterior and lateral views of the specimen shown in Figure 1.

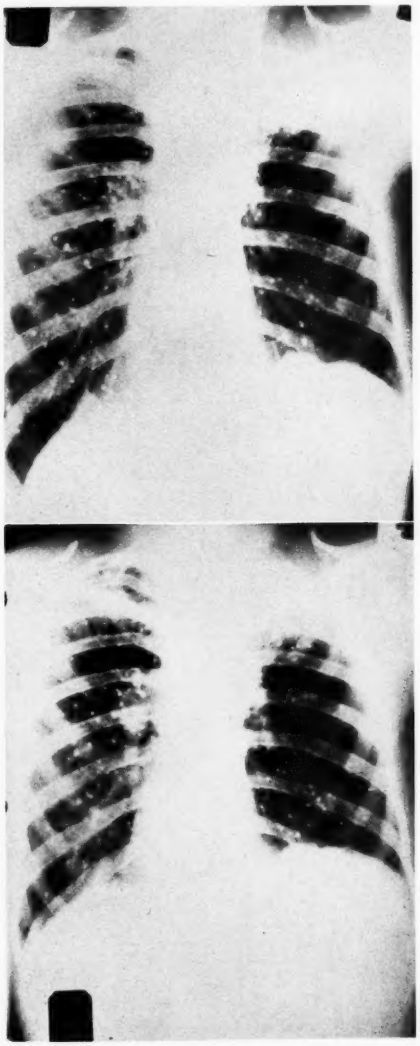

Fig. 3. Stereoscopic X-ray view of patient with disseminated nodular tuberculosis, after exhalation (raising the diaphragm). The contents appear to be posterior.

Experiment 2.—With the lung in the same position as in the second exposure, a thread was attached to the tip of one of the right lobes, and the tip pulled downward parallel to the direction of the tube shift (inhalation), a distance of 2 cm., and while it was in that position a third exposure was made. This is shown in Figure 2, which also is placed so that it may be viewed by a hand stereoscope to show the real and illusory positions of the various objects. The lung appears extremely distorted, which can be explained only when the movements are understood. The pull on the tip of the right lung stretched the whole right side downward with the shift, the bronchus and adjacent parts stretching the most with the displacement, gradually diminishing upward towards the trachea. This was possible because the cast was not completely "set." The outer and upper parts of the lung either lagged behind, or were actually tilted in the opposite direction. This combined effect would produce three distortions, *viz.*, (1) posterior, (2) loss of plasticity, and (3) anterior. The posterior distortion (*i.e.*, appearing toward the observer) is due to the lack of movement or movement opposite the shift, and is shown by the curling up of the tips of lobes toward the observer, as well as a nearer view of Pellet No. 4, which was suspended above the lung. The loss of plasticity is due to the movement of the main bronchus with the shift. When this movement is equal to the shift displacement, there is no plasticity. The object then appears flat and in the plane of the film (Pellets Nos. 2 and 3). When this shift displacement has been equalized and greatly exceeded, as in Pellet No. 1 and the tip of the lobe, they appear anteriorly (or away from the observer).

After this demonstration the study was directed to an actual living example, and we

were so fortunate as to find a suitable patient.

Experiment 3.—A series of exposures under different conditions were made as follows: First, a double exposure was made

Chart II. Sketches of double exposures taken of the patient shown in Figures 3 and 4. Dotted lines show the shift of the tubercles on a normal exposure. The solid lines show the shift of the same tubercles on raising the diaphragm (exhalation).

on the same film, one exposure before and one exposure after the shift. This doubly exposed film enabled us to measure the shifts of various shadows on one film with considerable accuracy. These are shown graphically by the dotted lines in Chart II, and reveal the fact that some of the shadows shift much more than others.

Experiment 4.—Two more sets of exposures were made, one with inhalation (lowering the diaphragm) and one with exhalation (raising the diaphragm) between exposures. The latter is shown in Figure 3, and reveals the fact that the position of much of the contents of the thorax appears to be posterior to the posterior ribs. The total shift of many of the shadows is shown by the solid lines in Chart II. There is about three times as much shift as in the correct exposure (shown by the dotted lines).

Subsequently, we observed that certain distortions took place even when respiratory and other external movements were controlled. It was first suspected, then demonstrated, that the heart movement produces almost as much distortion as do movements of the diaphragm. In fact, when there is

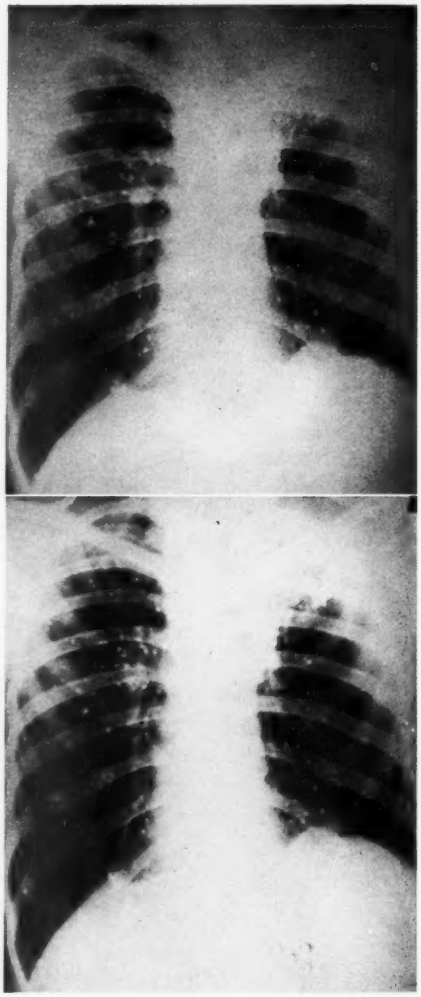

Fig. 4. Same as Figure 3 except that respiratory and cardiac movements were controlled as much as possible and so the contents appear in reasonably normal position.

otherwise good technic, this factor is the most common source of distortion, and one that has not been exhaustively studied.[2]

In this report we have made no attempt to "control" the heart movements with respect to the exposures further than crudely to expose pairs of radiographs in the same and in diametrically opposite phases of the cardiac cycle. The effect of this movement has wide possibilities, depending on whether the movement resulting is *with* or *against* the shift of the target. The vertical component of a movement *with the shift* will produce only a loss of plasticity, while displacement *against* the tube shift will project the image further posteriorly, depending on the amount of the displacement. For example, if the shift displacement on the radiographs is 1 cm., and the movement caused by the heart is 2 mm. (one-fifth the former), the lung would appear one-fifth, or 20 per cent, out of the chest posteriorly, and proportionally so for any other distance. With the first exposure during the height of systole, and the second similarly in diastole, the shift displacement would be lessened, with only a reduction of depth or plasticity. In addition to the vertical, there are other components that we have not attempted to study.

To test some of these hypothetic considerations, we performed two experiments in an attempt to establish them as facts.

Experiment 5.—A "normal" was made in which both films were exposed in approximately the same period of the heart cycle, the exposure being manually controlled by observing a blood pressure manometer. Although there is still slight distortion, the stereoscopic visualization is much more nearly correct than in Figure 3, in which deliberate respiratory movement had taken place.

Experiment 6.—Two exposures were made on the same film, approximately a half-second apart, so that the exposures would occur in the opposite phases of the heart cycle. There resulted a maximum of blurring and duplication of the shadows, especially in the right side, with an average displacement of about 3 millimeters. The direction is parallel to the shift throughout most of the field, but near the periphery it is more oblique or horizontal. Why the left side did not react in the same manner, we are unable to state, but it seems always to be so, and, of course, is dependent on the anatomic arrangements.

Experiment 7.—Another experiment was performed in which stereoscopic views were taken in the same phase of the cardiac cycle. Here the exposures were made in approximately the same phase and were reasonably correct (Fig. 4). All of these displacements can be explained, however, on a basis of movement with or against the shift between exposures.

Factors that may exaggerate the distortion by cardiac movements are consolidations or adhesions between the pericardium and the lung, or between the pericardium, lung, and thoracic wall. Each different possibility of anatomic aberration will be reflected in a different type of distortion unless the exposures are made at exactly the same phase of the cardiac cycle. Up to the present time, however, there is no simple, accurate means of accomplishing this, and until this is effected, exact localizations in the region of the heart will be impossible. Upper lobe lung localization can be accomplished, however, with a fair degree of accuracy, because these lobes are not disturbed so much by cardiac movements. In viewing a pair of radiographs caused by a diaphragmatic movement, distortion is not evident until the hilum is approached from above. Below the hilum it becomes gradually more marked. The distortion due to

[2]Since this work was completed we have learned of the excellent work of McPhedran and his associates, which aims to eliminate this source of error.

cardiac movements is more marked near the heart, but may be quite irregular if there are adhesions present, when the distortion varies with the extent and location of the adhesions.

DISCUSSION

Some of the important lessons of these studies are the bearing they may have on intrathoracic localizations and the interpretation of distortions appearing in routine stereoscopic examinations. As a result, more accurate localizations of lesions are made possible if unsatisfactory radiographs are discarded. Unless these distortions are recognized, however, localizations within the chest will frequently be difficult, if not impossible, to perform within a sufficient degree of accuracy to be of practical value. Respiratory movements are easily controlled and should offer no obstacle to accuracy. By superimposing the bony landmarks, such as scapulæ, clavicle, greatest width of thoracic cage, etc., such movements may be easily detected and the faulty radiographs discarded. The heart movements, however, are entirely different, because they are not under the control of the operator, and their detection is not so easy since no signs of them are apparent in the bony framework. There is no sure method of control except to attempt to obtain the exposures in the same phase of the cardiac cycle. This is difficult to do and our attempts have been very unsatisfactory except to point out the possibilities of such movements. Localizations near the heart are, therefore, unreliable, and, if fibrous adhesions exist either between the pericardial and visceral pleura or the visceral and parietal pleura, the situation is further complicated. Movements of from 2 to 3 mm. will produce gross distortions.

SUMMARY AND CONCLUSIONS

Evidence has been offered revealing various types of distortion of stereoscopic X-ray images in radiographs of the chest. Assuming that the exposures are taken in a correct manner with optimum tube shift and distance, and that the viewing apparatus is properly adjusted and correctly used, there are still possibilities of error due to movement between exposures if certain precautions are not closely adhered to. These errors are due to three types of movement: respiratory, cardiac, and that of the trunk as a whole. Cardiac movements are quite variable, but many times, if adhesions are present, they interfere with any localization around the heart. The type of distortion depends upon the direction of the motion, which, in turn, depends on the relative phase of the cardiac cycle at the instant of exposure.

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ROENTGEN DIAGNOSIS AND TREATMENT OF PERSISTENT THYMUS

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CONTROVERSIAL issues abound in medicine no less than in other scientific endeavors, and this is said without disparagement. In some cases the unquestionable association of cause and effect is convincingly established and needs no further elucidation or defense.

Ever since 1614, when Plater reported a sudden death, without apparent cause, in a five-months-old child, in whom necropsy revealed an enlarged thymus as the only abnormality, considerable discussion has beclouded the issue of status thymicolymphaticus, which was first advanced as a definite clinicopathologic entity by Paltauf in 1889. The latter described this condition as due to a decreased resistance of the body to shocks or injuries, dependent on a specific constitutional anomaly, shown anatomically by prominent thymic and lymphatic tissue. This has been generally accepted.

However, in 1926, the British Medical Research Council and the Pathological Society of Great Britain and Ireland appointed a joint committee to investigate status lymphaticus. The object was to establish by means of a large series of weights and measurements the standards for age and proportion to body weight of the normal thymus at all ages; also to investigate closely the cause of death in persons dying suddenly from unexplained or seemingly trivial causes, wherein the only apparent abnormality was the presence of a large thymus.

The committee determined that, in the normal series up to sixteen years of age, there appears to be little, if any, association

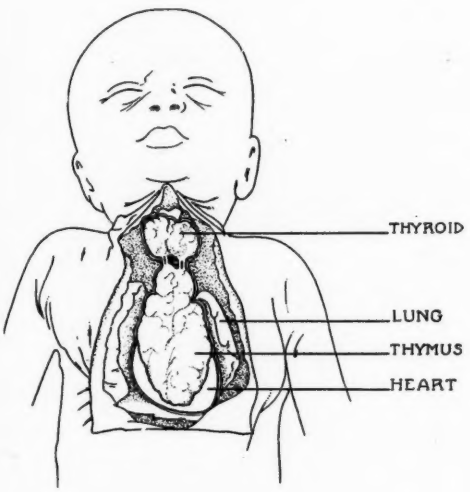

Fig. 1. Showing relation of the thymus to some of the neighboring structures.

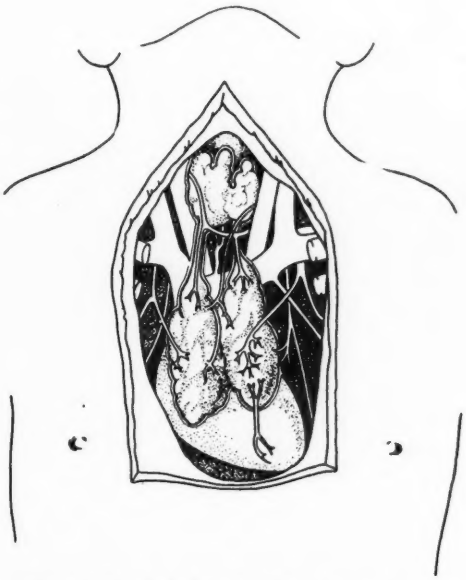

Fig. 2. Detailed dissection showing nerves and carotid and innominate vessels.
(From Crotti)

between the weight of the thymus and the amount of lymphoid tissue in the various parts of the body, insofar as this amount can be indicated by volumetric measurements of the faucial and lingual tonsils, selected lymph glands from certain sites, Peyer's patches, etc. The few data available show no concomitant general hyperplasia of lymphoid structure in cases with abnormally large thymus. They concluded that in many cases of Graves' disease the thymus was large, due to increase in glandular tissue, yet there was no definite general hyperplasia of lymphoid structures. They also agreed with Hammar and Greenwood, and Woods, that there is no evidence that so-called "status thymicolymphaticus" has any existence as a pathologic entity.

So, for the sake of agreement, let us acknowledge that there is such a thing as an enlarged thymus, since this committee has recognized its occasional presence, as have roentgenologists, also; certainly, pediatricians have clinically recognized its existence for a long time.

Noback has shown that the lobation of the thymus is determined early in fetal life, that the bilobed type of thymus predominates and that its location is most frequently cervicothoracic. The organ is distinctly broad in outline, extending laterally as far as the anterior axillary line in most cases, and is practically never overlapped by fetal lungs. This distinctly broad type of thymus, described as being the fetal type, he also showed to be typical of full-term, stillborn babies.

The thymus of infants in whom respiration has been established is usually cervicothoracic in location, is elongated in form, and bears the impress of the organs with which it is in contact. The right lung extends on its anterior surface in every case; the left lung extends over its anterior surface in four out of five cases. The thymus overlaps the right ventricle of the heart in more than 50 per cent of cases, and on the left side in more than 75 per cent.

The change from the broad type to the elongated type of thymus, found in the individual who has breathed, is accomplished during the period of time in which respiration is completely established. The expansion of the lung changes the position in relation to the thoracic contents, and, along with the other organs and viscera of the thorax, the thymus is markedly affected. It is compressed both laterally and anteroposteriorly, requiring a certain amount of molding.

Noback believes that, in the neonatal period, the degree of expansion of the lungs is a more potent factor in determining the lateral extent of the thymus than the actual size of the organ and, during this period at

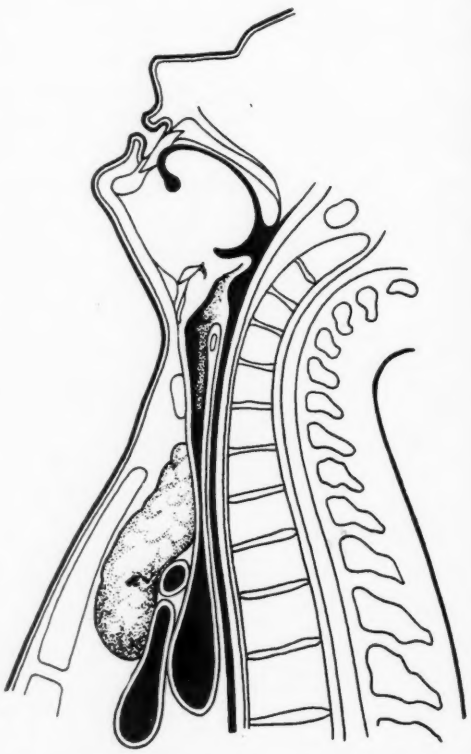

Fig. 3. Normal relation of thymus. Any increase in size would cause pressure symptoms at anterior spur triangle.

least, the thymus, lying in the usually described normal area, may exert marked pressure on the structures posterior to it. This may be due to an unusually large thymus or to a very narrow superior thoracic aperture, which will not allow the thymus to protrude into the cervical region, as it is compressed by the expanding lung.

Late in fetal life and in the unborn the thymus is related posteriorly to the pericardium over the base of the heart and great vessels. Noback says that in exceptional cases it extends to the left vagus nerve. On the right side it is generally found to be close to the superior vena cava, the left innominate vein and occasionally the superior vena cava being embedded in the posterior aspect of the thymus. In a few cases, he found that these vessels actually ran through the substance of the gland. The innominate

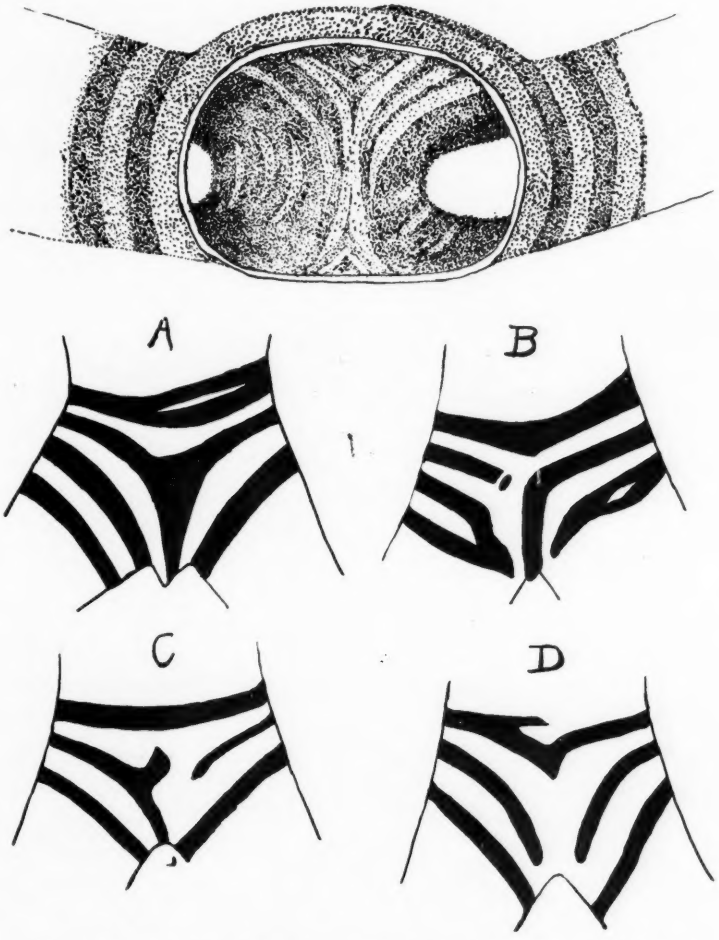

Fig. 4 *(upper)*. Cross-section of trachea, showing cartilaginous rings.
Fig. 5 *(lower)*. Various forms of tracheal ring architecture.

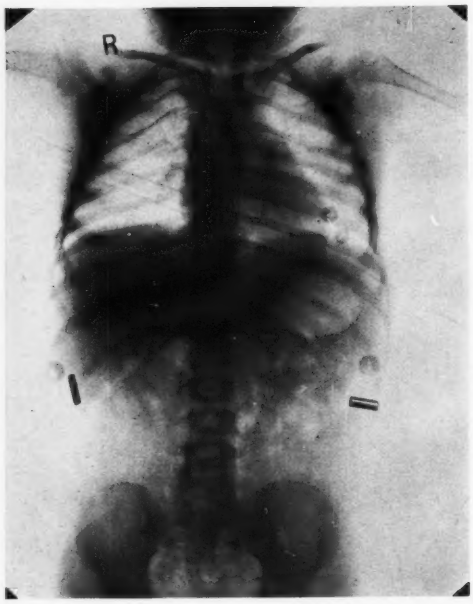

Fig. 6. In this case the spinal deformity confused the diagnosis; however, treatment was given, with abatement of symptoms.

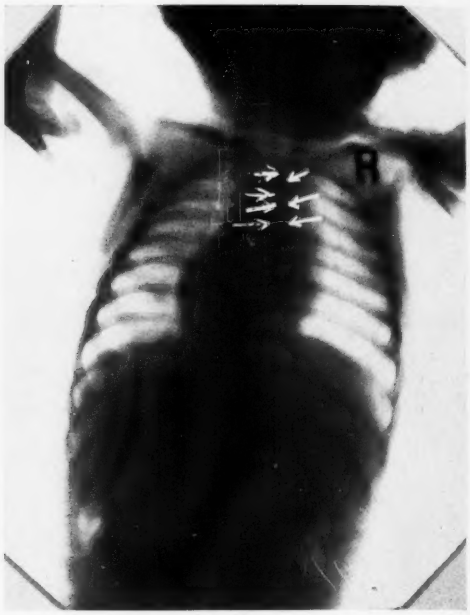

Fig. 7. Note tracheal displacement.

artery is closely applied to the trachea and crosses it diagonally, and the left innominate vein passes across the artery at the level of the upper border of the sternum. An increase in the anteropostero extent of the thymus in this region would, he says, due to the rigidity of the superior thoracic aperture, compress the above-named structures.

Jackson states that tracheal collapse in infants is as easy to accomplish as collapse of the bulb of a medicine dropper; also, thymic deaths under anesthesia attributed to status lymphaticus and hyperthymization of the blood are nothing more or less than arrested respiration due to obstructive pressure of the engorged thymus. In view of these observations and their confirmation by roentgenologic studies, the compression theory is tenable.

At this point it might be desirable to call attention to the work of Heller and von Schrotter regarding the anatomic structure

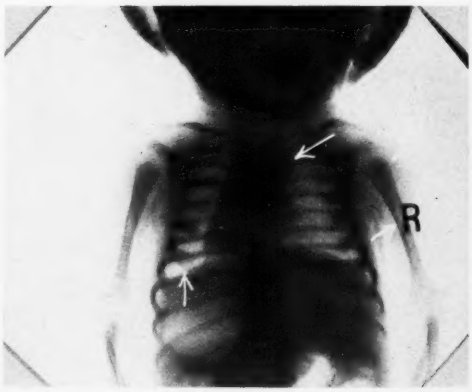

Fig. 8. Thymic enlargement is toward the right. Signs of rickets are present.

of the trachea and bronchi. Their results may be summed up as follows:

If the trachea is cut off 2 cm. above its division, an exact view of the place of bifurcation is afforded. One sees, looking at such a preparation from above, a nearly sagittally arranged larger or smaller ridge dividing the

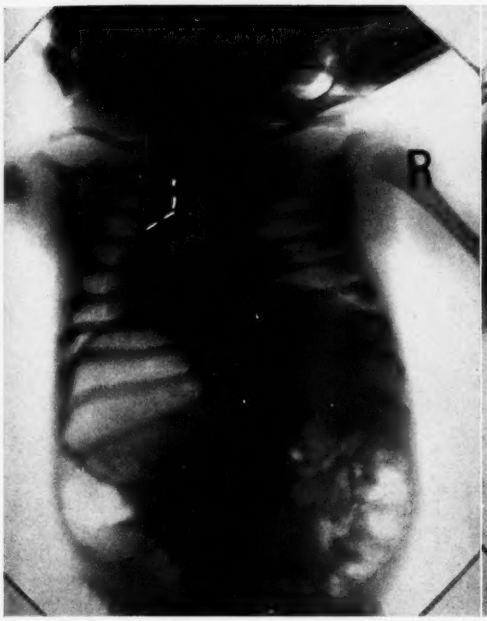

Fig. 9. Thymic enlargement is toward the left.

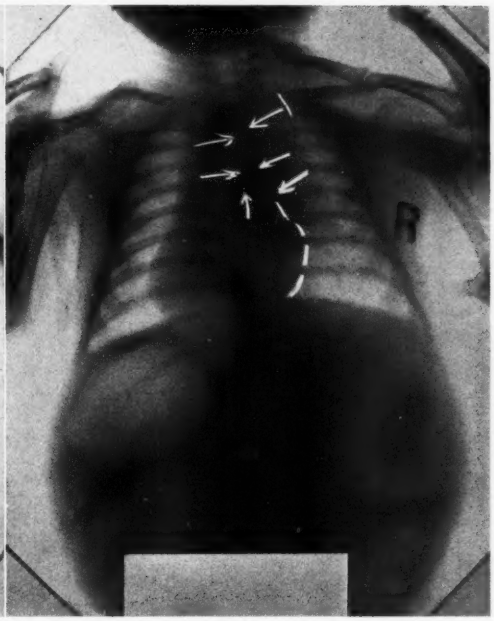

Fig. 10. Enlargement is essentially to the right.

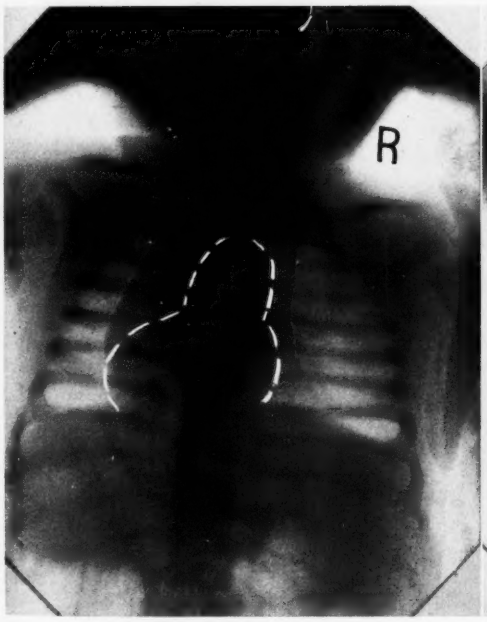

Fig. 11. Marked bilateral enlargement.

Fig. 12. Same case as shown in Figure 11, three months after treatment.

lumen of the trachea. The walls of this ridge enlarge toward the anterior wall of the trachea into a more or less triangular surface which is designated as the "anterior spur triangle"; toward the posterior wall the edges of the ridge diverge less, and there thus arises a small triangular surface of more or less inclination, called the "posterior spur triangle." The middle part of the spur connects these two surfaces with one another.

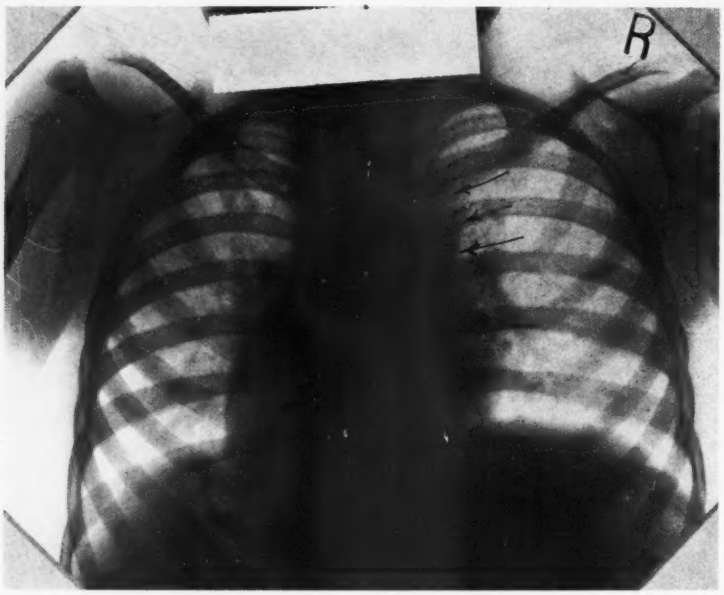

Fig. 13. Note the enlargement present.

In the majority of the tracheæ studied, it is the plate of cartilage corresponding to the last tracheal ring, or a cartilaginous process of the last tracheal ring, which enters into the spur. In these cases the spur was designated as "cartilaginous-tracheal."

It was often difficult to determine whether bronchial cartilages or tracheal cartilages entered into the formation of the spur. The usual distinction of a spur as bronchial or tracheal was to recognize whether the respective cartilage rings lay above or below the outer angle which corresponds to the division of the bronchi.

Out of the 125 human tracheæ investigated, the spur was found to be cartilaginous in 56 per cent; membranous, in 33 per cent; partly membranous and partly cartilaginous in 11 per cent; in 21 per cent it was bronchial, divided as follows—15 per cent bronchial right; 3 per cent bronchial left, and 3.5 per cent double bronchial.

The possibilities of compression are greater in those cases in which the tracheal rings are mechanically impaired.

Friedleben's studies in 1858 leaned largely toward the direct pressure theory and gave rise to the large controversial literature which exists to-day. That mechanical factors are concerned in some cases seems undeniable, but alone they by no means offer a wholly adequate or satisfactory solution, and the sudden arrest of the heart must be accounted for by some complex nervous or toxemic mechanism which up to the present

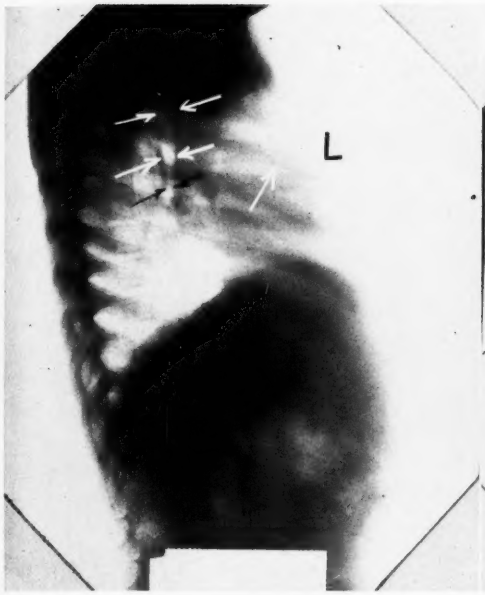

Fig. 14. Same case as shown in Figure 13, lateral film. Note tracheal compression.

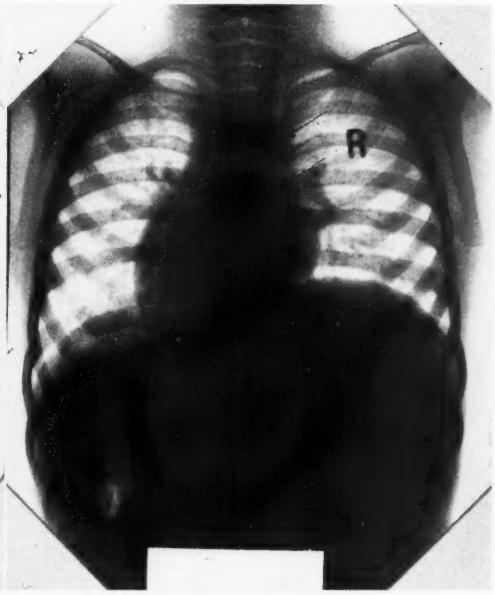

Fig. 15. Same case as shown in Figure 13, six weeks after treatment.

has not been satisfactorily explained. The early pathologic findings of hyperthyroidism are equally mystifying, although varied therapeutic interferences are used with varying degrees of success, in spite of the inability to advance a rational explanation of the mechanism of cause and effect. This thesis so far is presented to orient the pressure theory.

It is appropriate to mention the physiologic functions advanced by different authorities.

(1) Thymectomy has no effect on growth and development of skeleton or organ.

(2) Thymus feeding to salamander larvæ, with parathyroid, causes tetanus.

(3) Thymic hyperplasia in thyrotoxicosis is secondary.

(4) In birds, a relationship exists between the thymus and the egg-laying mechanism.

(5) One, if not the primary, function of the thymus gland is to produce leukocytes.

(6) The thymus may have antitoxic function.

(7) Thymic death, not due to tracheostenosis, probably bears no relation to the state of the thymus gland.

(8) Thymic hyperplasia in thyrotoxicosis is secondary.

(9) A substance is contained in the thymus, which, when injected, causes convulsions.

(10) Castration delays involution of the thymus.

(11) The thymus is not necessary to life.

It is known that the gland is a temporary or transitory organ of extra-uterine life, attaining its largest size at or soon after birth, and that it exists under three or four morphologic conditions.

We now enter the realm of roentgenology. Wasson, making serial roentgen-

ograms and serial physical examinations from birth to the age of three years, has made a thorough study of a group of children. From roentgenologic and necropsy studies, he concluded that the two auricles and the great vessels form the base of the

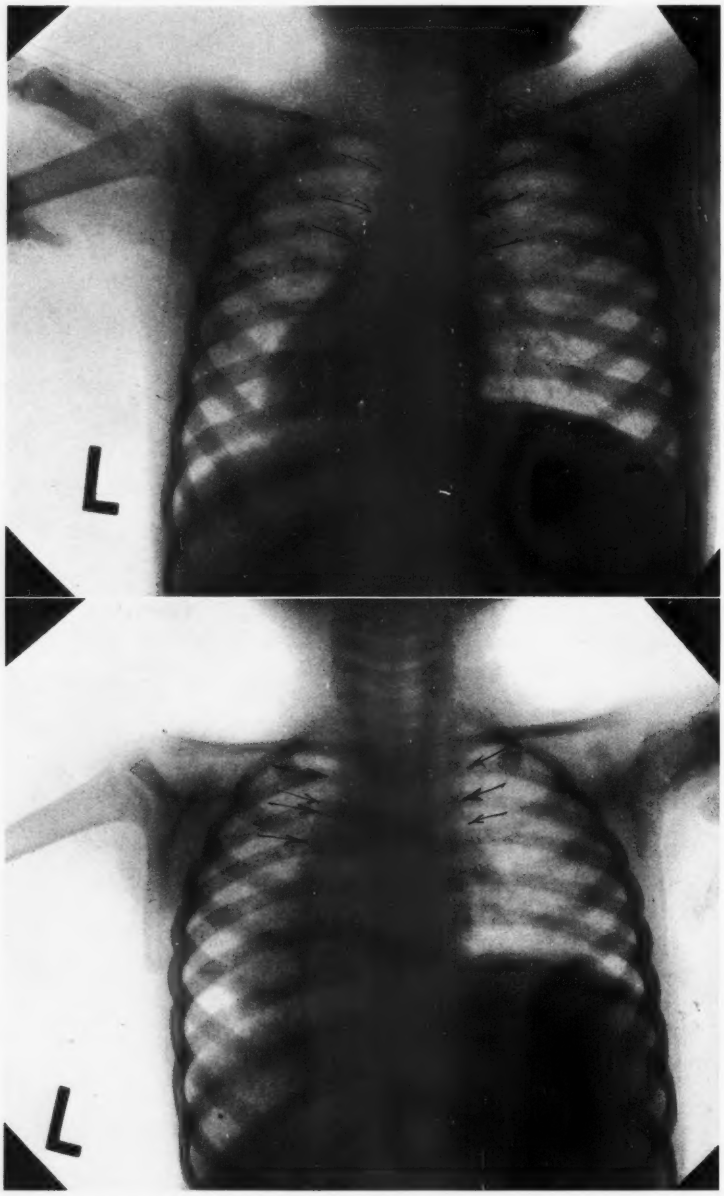

Fig. 16 *(upper)*. Film after deep inspiration showing the mediastinal shadow. Compare with Figure 17, taken after deep expiration.

Fig. 17 *(lower)*. Note transverse increase in mediastinal shadow, some of which is probably due to flattening of a large thymus. The thymus, in this instance, is increased in depth and manifest only after expiration.

heart shadow; the aorta, which lies in the middle of the mediastinum, in the new-born infant is not seen as a distinct shadow because of its position. It passes directly up, turns directly back, and passes down behind the heart; it is only in later life that it forms the typical aortic arch seen in adults.

If there is no sizable thymus present, the great vessels, the vena cava, aorta, and pulmonary artery, form a shadow, triangular in shape, which quickly narrows as it passes upward toward the first rib, and at its narrowest point is less than the transverse diameter of the shadow of the spinal column. If the thymus is considerably enlarged, it will be found to overlap the base of the heart, obscuring the shadow just described by the great vessels. The shadow of this thymus is triangular in shape, with its base overlapping the base of the heart and especially the auricles. Its transverse diameter at its broadest point, which is usually the third interspace, may be two or three times the diameter of the shadow cast by the thoracic spine. This shadow of the thoracic spine is taken by measuring the diameter of the vertebral body. If the shadow of the thymus is no greater than that cast by the great vessels, it is a small thymus. This applies only when the roentgenograms are taken in the postero-antero-recumbent position. The usual normal thymic shadow is about one and one-third times that of the vertebræ. Wasson concludes that, in infants under two years of age, the thymus is variable in size, not only in different types of infants, but in the same infant at different times. These thymuses may be classified as to size, and it is fairly definitely established that underweight infants have small thymuses, and those who are overweight have large thymuses. While the average-weight infant usually has a moderate sized thymus, this does not adhere so strictly to the rules. There is an increase in the thymus from birth to one year of age; it then reduces in size noticeably up to the thirty-second month. Wasson calls this the thymic cycle.

Whenever possible, it is desirable to make a lateral projection in order to note a possible compression of the trachea; but, because of the infant's intractability, this cannot always be done. It is well to take a film after inspiration and another after expiration; however, infants are incapable of understanding co-operation and, therefore, ordinarily the examination must of necessity be limited. These films might show a comparative spread of the thymus, which is occasionally greatly increased if the thymus should be large in its anteropostero dimension, the increase being shown in the film taken after expiration.

The question of a differential diagnosis is to be considered and the help of a pediatrician is of inestimable value. Confusion arises with the following simulants: congenital heart disease, meningitis, whooping cough, asthma, adenoids, congenital atelectasis, recurrent laryngeal paralysis, laryngeal stenosis, tracheal stenosis, retropharyngeal abscess, and foreign bodies.

The clinical evidences of thymic enlargement, such as transitory cyanosis, dyspnea, croupy cough, choking, and breath-holding, are common in these conditions, therefore care is necessary in the selection of remedial measures.

Lange, in 1911, made quite an exhaustive report on the roentgenologic treatment of enlarged thymus. Since then, X-ray treatment has been practised with apparently good results; as a matter of fact, no other form of satisfactory treatment has supplanted it. Singularly enough, because the structure is predominantly lymphatic, it is highly susceptible to light doses of X-ray.

Since it is always desirable to establish the safety of any therapeusis, Barnes, in 1929, made a study of 63 children who had received treatment from three and one-half to eight years previously, but he failed to demonstrate any constant deviation from

normal, either mental or physical. The dosages used, while somewhat high, in the light of our present knowledge, were apparently within the range of safety.

Treatment.—There is no need to apply larger doses than necessary and a certain amount of judgment in deciding the factors is desirable. In practically no instance is it necessary to give over one-quarter of an erythema dose at one time; usually one-sixth, or occasionally one-eighth, of an erythema dose may be indicated at one time. In the average case, three treatments are given, about two or three weeks apart. In this way involution is gradual and increased symptoms due to engorgement and toxemia are avoided. In rare instances, eight treatments are necessary. The writer had two instances in which an early X-ray examination, made as a precautionary measure, was negative, but several months later symptoms and re-examination revealed the presence of a large thymus. In both cases X-ray therapy abated the symptoms. These cases indicated that a latent or delayed pathologic thymus may exist.

The larger the thymus, usually the smaller the dose, also, the greater the evidences of inanition, the smaller the dose. While it is desirable to make repeated X-ray films at monthly intervals, the sole criterion is the evidence of improvement, which is remarkably obvious within from a few days to a few weeks.

The technical factors are 110 K.V. peak, 5 ma., 4 mm. aluminum filtration, and two variables, namely, time and skin focal distance.

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X-RAY TREATMENT IN GYNECOMASTIA

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BALTIMORE, MARYLAND

GYNECOMASTIA has been under discussion since the days of Aristotle (1) and many theories have been advanced concerning its causation. Up to the present time, however, none has proved satisfactory. Some of the most comprehensive early articles on this subject were written by Gruber (2), Laurent (3), Olphan (4), and Schuchardt (5).

Gynecomastia implies swelling of the male breast, which may be diffuse, local, unilateral, or bilateral. Clinically, gynecomastia may be divided into diffuse and local (fibro-adenoma) hypertrophies: either may be unilateral or bilateral. Pathologically the local and the diffuse hyperplasias cannot be separated, for the early picture of hyperplasia gradually changes into fibro-adenoma. In other words, the young periductal fibroblastic tissue, present in early hyperplasia, gradually condenses and in time becomes a dense fibrous stroma which is typical of fibro-adenoma. This conclusion was reached after studying eighty-eight cases of gynecomastia, including a correlation of history, physical, laboratory findings, and a follow-up of the cases. The microscopic sections were compared to those of female breasts suffering from similar conditions. This study will be reported in another paper.

The first authentic report regarding treatment of swelling of the male breast was advanced in 1556 by Paulus Aegineta (7), who advised surgical removal. Since the majority of the cases are symptomless and complain only of deformity, treatment is seldom sought. However, the disfigurement has been responsible, ni the case of some sensitive patients, for attempts at self-amputation, in an effort to be rid of the shameful swelling. Christopherson (8), in 1904, called attention to a boy who was so despondent over his affliction that he attempted self-mutilation. When seen, he had amputated one breast and, losing courage and strength, had only partially amputated the other breast. In 1837, Petrequin (9) reported a case in which the patient's mortification was the direct cause for amputation of both breasts. From the beginning of the nineteenth century it had not been uncommon to amputate one or both breasts for the deformity associated with gynecomastia.

In addition to deformity, pain is sometimes a complaint of gynecomasts, and although treatment for this symptom has not been as radical, patients have frequently subjected themselves to amputation in an effort to eliminate this sensation.

In 1922, Loederich and LeGoff (10) used radiotherapy in a 76-year-old patient suffering from an enlarged, tender, and painful breast. They reported a complete disappearance of pain, considerable decrease of tenderness, and a marked diminution in the size of the gland, following this treatment.

Because so little is known of the effect of X-ray treatment in gynecomastia and since such an excellent result was obtained in one of the author's cases, the following case reports are presented with the hope that they will bring to light another method of combating this clinical entity.

CASE REPORTS

Case 1. The patient was a white male, aged 12, who came to the hospital complaining of an enlarged right breast, which for the past few days had caused pain. In Sep-

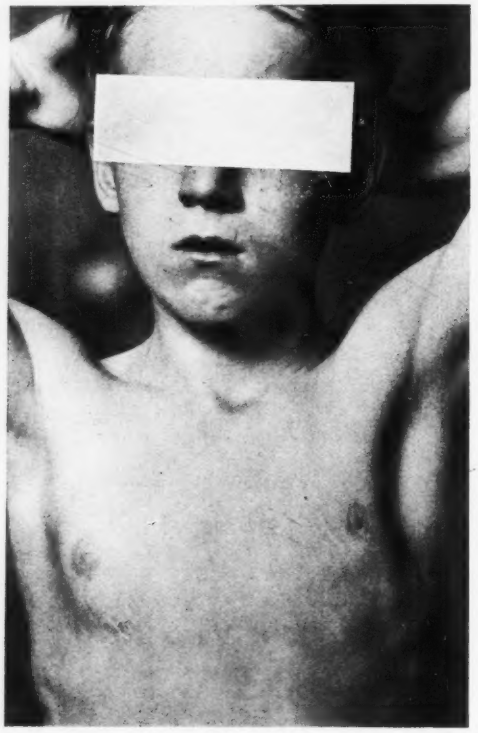

Fig. 1. Case 1. A white male 12 years of age showing a diffuse enlargement of the right breast of seven months' duration.

tember, 1922, he first noticed a gradual, diffuse, painless swelling, about three inches in diameter, of the right breast, which gave the sensation of fullness. Seven months later, and one week previous to examination, the patient traumatized his right breast while playing and this was followed by a diffuse "pin point discomfort" which lasted three days. Four days later, on April 19, 1923, the patient presented himself for examination (Fig. 1). Previous to this the patient had not suffered from any sudden enlargement, disappearing tumefaction, or nipple discharge. No symptoms were noted in the left breast.

The past and family histories were essentially negative.

Physical examination showed a distinct, diffuse enlargement of the right breast, with no visible lesions. Palpation revealed this enlargement to be free from the skin and the underlying tissues. There were no palpable masses and no enlargement of the axillary glands. The genitalia were normally developed for a boy of his age. The rest of the physical examination, including the left breast, was essentially negative.

Laboratory Examination.—The X-ray examination showed no evidence of lung metastasis. The Wassermann test and complete blood examination were negative. A urinalysis revealed a specific gravity of 1.004, a trace of albumin, and an occasional pus cell. The blood pressure was 90/30.

Treatment.—Three X-ray treatments were administered at intervals of two weeks. In each treatment the following procedure was adopted: Area over right breast, anteriorly, one-half hour; 175 K.V.; 5 ma.; filter of 1 mm. copper and 1 mm. aluminum; 22-inch focal distance.

Progress Notes.—Following each treatment a perceptible decrease in the size of the right breast was noted. This decrease in size was so marked after the third treatment that irradiation was discontinued. For the following four months the patient was seen once a month and each time the right breast was noticeably smaller. Four months after the last treatment the swelling had practically disappeared.

On October 26, 1931, eight and one-half years after the last X-ray treatment, the patient was examined by the author (Figs. 2-*A* and 2-*B*). Since his last examination he has noticed no swelling nor has he felt any pain or discomfort. He had been entirely oblivious to his former affliction until recent communications reminded him of it. Physical examination at this time revealed the right breast to be identical with the normal left breast. No visible lesion, discharge, nipple retraction, or swelling was noted. Palpation revealed no glandular or soft part enlargement beneath the nipple.

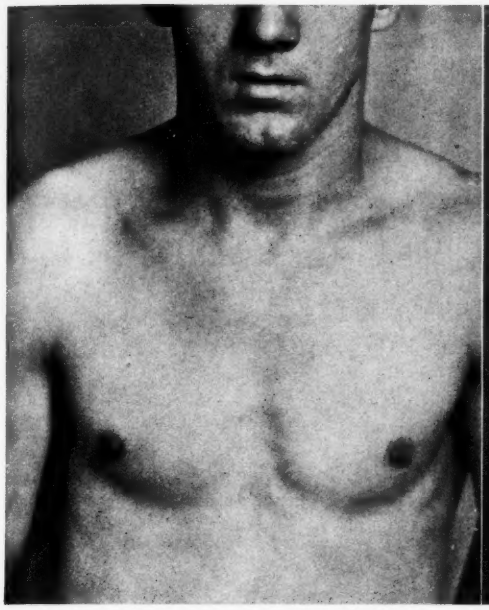

Fig. 2-*A*. Case 1. Anterior view of the patient shown in Fig. 1, eight and one-half years after the last administration of irradiation by deep X-rays, showing an absence of gynecomastia.

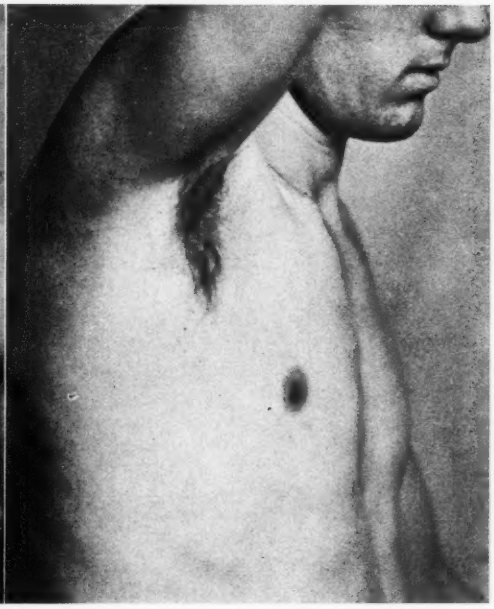

Fig. 2-*B*. Case 1. Lateral view of the patient shown in Figure 2-*A*.

The remainder of the physical examination, including the genitalia, was essentially negative except for a beardless face and a moderately high pitched voice, neither of which is uncommon at 20 years of age.

Case 2. The patient, a white male, 23 years of age, accidentally noted tenderness and a small mass about two centimeters in diameter, posterior to his left nipple. The mass for the first few months fluctuated in size and tenderness, but for the following two and one-half years there was a gradual increase in size, with no change in tenderness. Approximately three years after the onset nine treatments of deep X-ray were given on nine successive days, the total amount being similar to that used in Case 1. For the first three weeks following treatment the patient thought that there was an improvement in his condition. However, after the first month, the gradual growth and constant tenderness were again noted. One year following X-ray treatment, the patient presented himself for examination. At that time inspection revealed a fullness of the left nipple. On palpation a firm, slightly tender, freely movable mass about five centimeters in diameter, posterior to the left nipple, was found.

Laboratory Examination.—The X-ray examination was negative. The blood and urine examinations were negative.

Operation.—A complete excision of the areola and glandular mass was performed.

Post-operative Findings.—The patient made an uneventful recovery. To-day, eleven months later, this patient is living, with no recurrence of the tumor mass.

Gross Specimen.—A circumscribed, bluish-white, firm mass posterior and inferior to the nipple, measuring $4 \times 3 \times 2$ centimeters was noted (Fig. 3). Gross sec-

Fig. 3. Case 2. Gross specimen of unilateral gynecomastia in a white male 23 years of age, showing a mass, posterior and inferior to the nipple, which had been present for three years. This breast had received irradiation for a nine-day period.

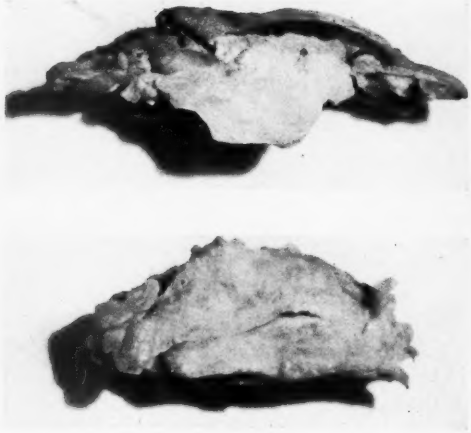

Fig. 4. Case 2. Cross-section of specimen shown in Figure 3, showing dense fibrous striations through which bluish-white tissue projects.

tion (Fig. 4) revealed dense fibrous striations through which bluish-white tissue projected. Occasional yellow opacities were also seen.

Microscopic Section.—The tissue revealed a mild hyperplasia of the duct parenchyma, with a slight tendency toward cell atrophy (Fig. 5). In areas, slight desquamation into the duct lumen was present. The periductal as well as the interductal fibrous stroma was dense, being composed of adult and well formed fibroblasts. In the periductal stroma

Fig. 5. Case 2. Microscopic section of the specimen shown in Figure 3. It presents an adult fibrous periductal stroma and a slight atrophy of the hyperplastic duct epithelium.

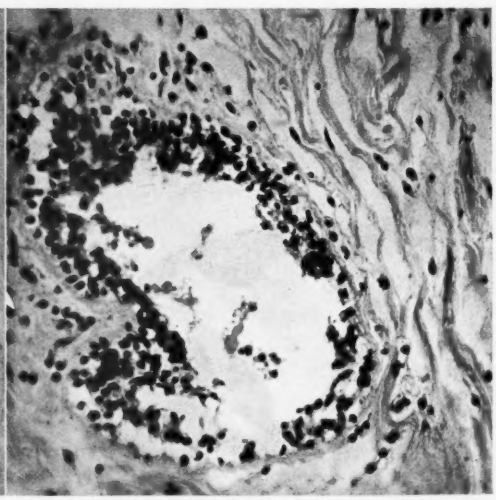

Fig. 6. Case 4. Microscopic section of a white male 44 years of age showing atrophy, desquamation, and breaking up of the parenchymal cells lining the duct lumen. The breast of this patient received irradiation by deep X-rays. (Compare with Figure 7.)

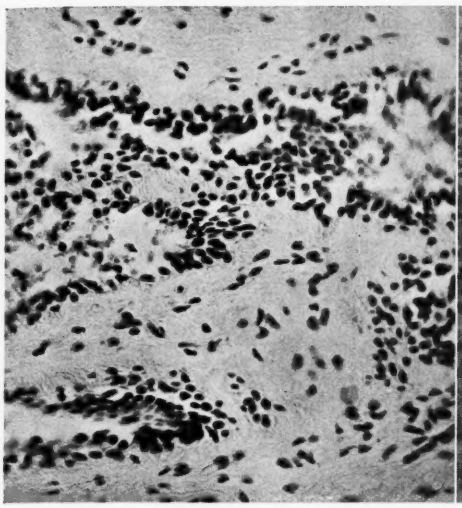

Fig. 7. Microscopic section of a normal, non-irradiated breast taken from a 65-year-old male showing desquamation, atrophy, and a breaking up of the parenchymal cells lining the duct lumen.

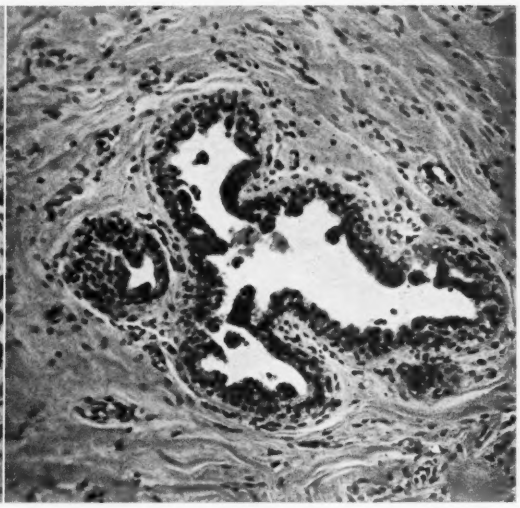

Fig. 8. Microscopic picture of gynecomastia occurring in a white male 17 years of age, showing hyperplasia of intact parenchymal cells lining the duct lumen and surrounded by a dense fibrous stroma. This case was not irradiated and is shown only for comparison. (See Figures 6 and 7.)

mild lymphocytic infiltration was occasionally seen.

Case 3. Six weeks previous to examination the patient first noticed a "small lump" in his right breast and a needlelike pain, originating in his right nipple whenever it was touched. No improvement was noted. Four weeks later, he was given one deep X-ray treatment by his physician.

Physical examination revealed a poorly developed, white male, 67 years of age. The right areola was slightly more prominent than the left. On palpation a circumscribed, freely movable, slightly tender mass about five millimeters in diameter, in the upper outer quadrant of the right breast, was noted. The remainder of the physical examination was negative.

Laboratory Examination.—The X-ray examination was negative. Both the blood and urine examinations were negative.

Operation.—The areola and tumor mass were completely excised.

Result.—The patient died fifteen months later from "bladder inflammation."

The gross and microscopic sections are similar to those of Case 2.

Case 4. Four months previous to examination the patient noted tenderness and a small "lump" below his right nipple, both of which gradually increased for three months. At the end of this time, he was given X-ray treatment by his physician, but the tenderness and swelling persisted.

Physical examination revealed a white male, age 44. The right nipple was slightly higher than the left.

On palpation a flat, definite, indurated mass about two centimeters in diameter was found, attached to the nipple but not to the underlying structures. The remainder of the physical examination was negative.

Operation.—The right breast was amputated.

The gross specimen presented a firm, fibrous, tumor mass, posterior to a normal

nipple, with ill-defined edges measuring from one and a half to two centimeters.

The microscopic section showed a duct hyperplasia with desquamated cells in its lumen and an apparent atrophy of the parenchymal cells (Fig. 6). The stroma was dense and fibrous and contained a slight lymphoid infiltration in its periductal bed.

Result.—The patient could not be located five years later.

DISCUSSION

In an effort to explain the result of X-ray treatment in gynecomastia one must first realize the presence of a hyperplasia of the parenchymal cells, together with a hyperplasia of the periductal, loose, young, connective tissue stroma in this condition. This type of stroma is frequently seen in gynecomastia of short duration. Irradiation seems to have a specific retarding effect on the growth of this young connective tissue element, as well as a tendency to produce atrophy of the parenchymal cells. If the hypertrophy is maintained for a longer period of time, the young fibrous tissue condenses and becomes more mature. X-ray treatment does not seem to have any effect on the maturing or matured fibrous hyperplasia.

In Case 2 the mature fibrous element had already formed when X-ray treatment was given, consequently the total effect produced seemed to be a slight atrophy of the parenchyma.

In Cases 3 and 4 the amount of X-ray treatment given is not known. The lapse of time between treatment and operation was too limited to justify a conclusion that the results were poor. However, the microscopic picture in both cases offers an explanation by presenting an adult stroma and an atrophy of the parenchymal duct cells.

TREATMENT

In all probability the first treatment used in tumefaction of the male breast was rest and advice not to manipulate the part. This was the natural result of the limited knowledge of gynecomastia that prevailed at the time.

Up to the present time, the accepted treatment for cases of gynecomastia has been to leave them alone. If pain is not relieved by suggestive and palliative measures, and if the deformity is a constant source of mental anxiety, amputation is considered.

In view of the findings recorded, X-ray irradiation should be resorted to in all cases of gynecomastia of short duration. Best results seem to be obtained in the diffuse enlargements in cases in which the young periductal fibrous tissue is in abundance. After X-ray treatment has been given a fair trial, if the results are found to be unsatisfactory a more radical procedure is to be considered. Deaver and McFarland (11) are of the opinion that amputation of the breast, or breasts, affords the only lasting benefit in gynecomastia.

CONCLUSIONS

1. Gynecomastia may be local, diffuse, unilateral, or bilateral.
2. The hyperplasia of gynecomastia gradually changes into the so-called fibroadenoma.
3. The early hyperplasia in gynecomastia seems to be sensitive to X-ray irradiation.

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Way Nerves Act on Muscles Discovered.—The mechanism by which a nerve impulse can be converted into a chemical stimulus has been indicated in studies reported by Prof. Walter B. Cannon, of Harvard Medical School, to the Association for the Study of Internal Secretion. Prof. Cannon described his newly discovered hormone, sympathin, which is found very generally in smooth muscle tissue. It is probably the same as adrenalin, the stimulating secretion of part of the adrenal glands. The action of the two substances—sympathin and adrenalin—is apparently very similar.

The discovery of sympathin is expected to have great practical importance. Secretion of sympathin from a muscle cell upon stimulation by a nervous impulse may be the way in which the nerve impulse can cause activity of tissue.—*Science Service.*

DIRECT COMPUTATION OF DEPTH INTENSITY

By KENNETH S. COLE, PH.D., Department of Physiology, Columbia University, and Roentgen-ray Department, Presbyterian Hospital, NEW YORK

IN DEEP therapy, sufficient radiation should be absorbed by the tissue under treatment to give the desired effect without there being enough radiation absorbed at the skin to produce a severe reaction. If treatments are to be put on a quantitative basis, it is then necessary to know the amounts of radiation absorbed—preferably expressed in r units—at both skin and depth, so that the clinician may learn by experience what quantities are necessary to produce reactions at the skin and in various tumors. Thus it is important to be able to compute the depth intensity simply and easily.

Most, if not all, published phantom measurements give intensities of radiation relative to the intensity at some point in the phantom. This point is usually at the surface for some arbitrary area of field. If we then wish to use these measurements to find the intensity at a certain depth, we must measure the intensity for at least one point in a phantom. Since water phantom measurements are inconvenient at the best, it seemed expedient to make them once and for all in terms of the intensity of the radiation as measured in air without back-scattering at the skin-target distance.

The X-ray tube was operated at 200 K.V., 8 ma. constant potential. At 50 cm. it gave the copper filtration intensity data of Table I, without back-scatter. Table II gives the percentages of the intensity in air which are found for different depths, fields, and filters. The very striking result is that, for any given filter, field, and depth, the phantom intensity is always a constant percentage of the air intensity for the same filter—no matter if it be 0.55 mm. or 2.62 millimeters. For convenience this percentage is called the phantom factor or ratio. In Table III the data from Table II at 10 cm. depth and different fields are compared with those of Failla and Quimby (Table XVI and Figure 8).[1] The agreement is good enough to justify the use of Failla and Quimby's data in computing the phantom factor for different fields at the other depths from the

TABLE I

Filter 1 mm. Al + mm. Cu	Intensity r/min.
0.55	22.2
1.1	14.6
1.86	9.6
2.62	6.6

[1] G. Failla and E. H. Quimby, Am. Jour. Roentgenol. and Rad. Ther., December, 1923, X, 944-967.

TABLE II

Filter 1 mm. Al + mm. Cu	Air Intensity 50 cm.	Phantom Intensity							
		10 cm. depth				15 × 15 field			
		20 × 20	15 × 15	10 × 10	6 × 8	10 cm.	8	6	4
0.55	100	47.7	45.0	35.3	25.8	45.0	62	79	100
1.1	100	49.8	45.0	35.8	26.8	45.0	63	79	102
1.86	100	48.6	41.6	34.8	27.2	41.6	60	80	100
2.41	100	.....	.....	35 2	.....	.....	.....	....	.....
2.62	100	48.3	43.6	.....	26.6	43.6	61	83	103
Average	100	48.6	43 6	35.3	26.6	43.6	61.5	80	101

depth data with 225 sq. cm. field. These results are given in Figure 1.

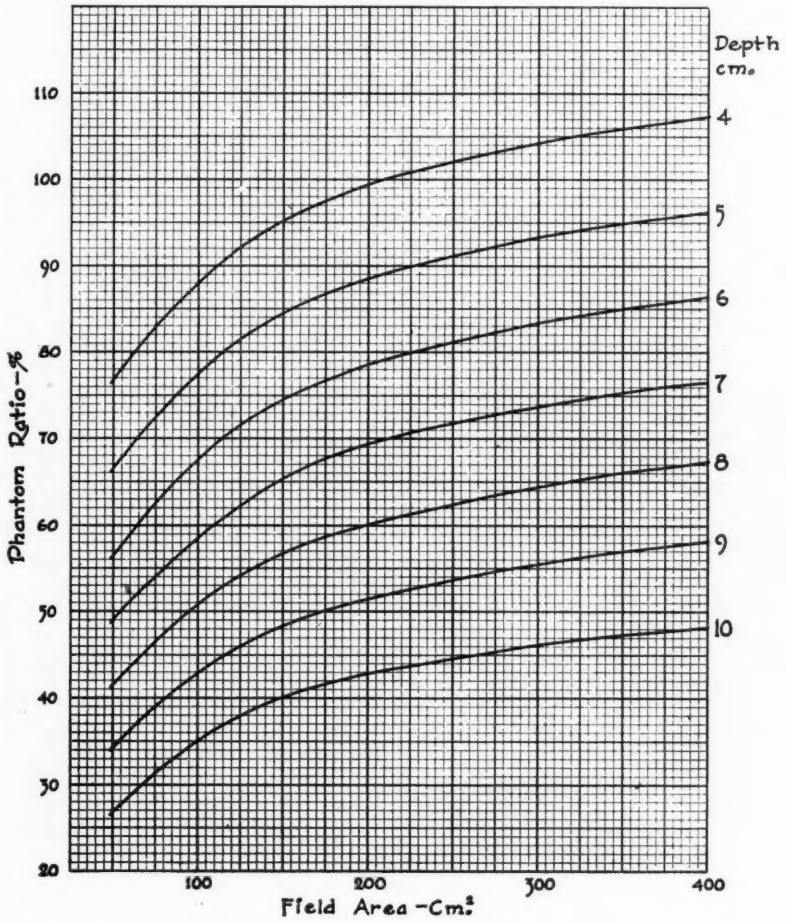

Fig. 1.

The set of curves shown in Figure 1 make it surprisingly simple to compute the amount of radiation absorbed by any underlying tissue. Let us suppose that 600 r (measured in air) have been given over a skin area of 144 sq. cm. with 50 cm. skin-target distance. We then know immediately that a tissue at a depth of 5 cm. has absorbed 500 r since this phantom factor is 84 per cent from Figure 1. This result is the same when the 600 r is given with any filtration between 0.55 mm. and 2.62 mm. copper. Conversely, this phantom factor should be independent of the tube voltage for at least a limited range. This points to the interesting suggestion that the use of high voltage and heavy filtration is of slight value in giving

TABLE III

Field	Table II	F.-Q.	Ratio
400	.486	1.38	.352
225	.436	1.25	.348
100	.353	1.00	.353
48	.266	0.78	.341

greater depth intensity. Suppose it is known in advance that a region 10 cm. deep should have 350 r through a 315 sq. cm. field. From Figure 1 the phantom factor is 46.5 per cent, so 750 r (measured in air) must be given. It now remains to choose such filter and voltage that 750 r will not produce a skin reaction on the 315 sq. cm. field. Filter and voltage are the factors to be adjusted to protect the skin after the quantity of radiation (as measured in air) necessary to produce the desired depth intensity is known from clinical experience and the phantom factor.

Further measurements are planned to set the limits of voltage and filter on the phantom factor, to check the application of Failla and Quimby's inverse square relation to the phantom factor at other S.T.D., and to find the minimum depth at which the phantom factors may be used. It is obvious that their independence of wave length must fail at and near the surface since the usual depth dose is not independent of wave length.

List of All Science Journals being Compiled in England.—British scientists are now listing all the periodicals of science. A new edition of the "World List of Scientific Periodicals," the first edition of which contained titles of some 24,000 periodicals, is to be issued soon. The editor is W. A. Smith of the British Museum.—*Science Service.*

SYSTEMIC BLASTOMYCOSIS, WITH REPORT OF A FATAL CASE

By ISTVÁN GÁSPÁR, M.D., WALTER A. FENSTERMACHER, M.D., and LESLIE R. LINGEMAN, M.D.

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CASES of systemic blastomycosis, though the disease is fairly widespread, are still not very common. In spite of the excellent reviews on the subject and the many cases of systemic blastomycosis which have been reported in the various medical journals, it seems to us that our case, studied from clinical, roentgenologic, bacteriologic, and histopathologic points of view, warrants its publication.

At the Rochester General Hospital two cases of systemic blastomycosis have been seen within the last three years. The first one, in which a hen's-egg-sized tumor of the leptomeninges was removed from a 52-year-old white male, was a so-called primary meningeal form and has been reported elsewhere. The tumor showed a great number of budding organisms and a characteristic microscopic picture, however, the case was not entirely conclusive because only histologic examination was done. Cultures could not be prepared and autopsy was not obtained. The second case of systemic blastomycosis with multiple foci was observed during 1930. At the time of the patient's admission only a few lesions were found, nevertheless the correct diagnosis was established in a few weeks, thus determining the available treatment and the poor prognosis. The case is as follows:

CASE REPORT

C. P., male, Italian parentage, aged 19 years, entered the hospital Feb. 22, 1930, with the following chief complaints: (1) sores on right foot and right wrist, (2) swellings of knees, (3) weakness. The family history was irrelevant.

Past History.—The patient was born in, and has always lived in, New York State. He was in the Rochester State Hospital from Sept. 30, 1928, to April 26, 1929, with the diagnosis of dementia præcox. No history of past diseases or symptoms was obtained on searching inquiry. He had been unemployed for some time, though he had previously worked in a grocery store. Most of the history of his present illness was obtained from the family, who had considered the patient physically well until December, 1929. During that month, after a slight trauma, the patient noticed a sore on the right foot, with accompanying fever. The lesion was incised and "pus" obtained; however, drainage of the thin fluid was continuous. The right, and later the left, knee became swollen and painful. Swellings and later ulcerations of the right ankle and right wrist were noted. Fever of varying degrees had been present since the beginning of the illness. Progressive weakness and a loss of ten pounds were experienced. There had been an occasional cough and on one or two occasions a small amount of blood-tinged sputum was expectorated. No gastro-intestinal or genito-urinary symptoms were present. There was no change in the mental state.

Physical Examination.—Physical examination revealed that the patient was well developed, but poorly nourished, with an appearance of chronic illness. The skin was yellow, with numerous acneform lesions over the face and chest, and the general hygiene was poor. The patient possessed a grinning face, and talked in a foolish way, giving irrelevant answers. He was dull, uninterested, and unable to discuss his condition.

Examination of the eyes showed that the right pupil was larger than the left, both reacted sluggishly to light and accommodation. The fundi were negative.

Throat and mouth: Considerable post-nasal discharge was present. The tonsils were enlarged and very cryptic. One or two carious teeth were present. The tongue was white-coated and dry.

Chest: The expansion was fair, but the right chest lagged on inspiration.

Lungs: On the right there was relative dullness over the first, second, and third intercostal spaces anteriorly and posteriorly, with diminution in breath sounds anteriorly. The voice sounds were slightly increased. No râles were heard.

Heart: Blood pressure, 120/80. The apex was at the fifth intercostal space, 10 cm. to the left of the midsternal line. Rhythm was regular and there were no murmurs.

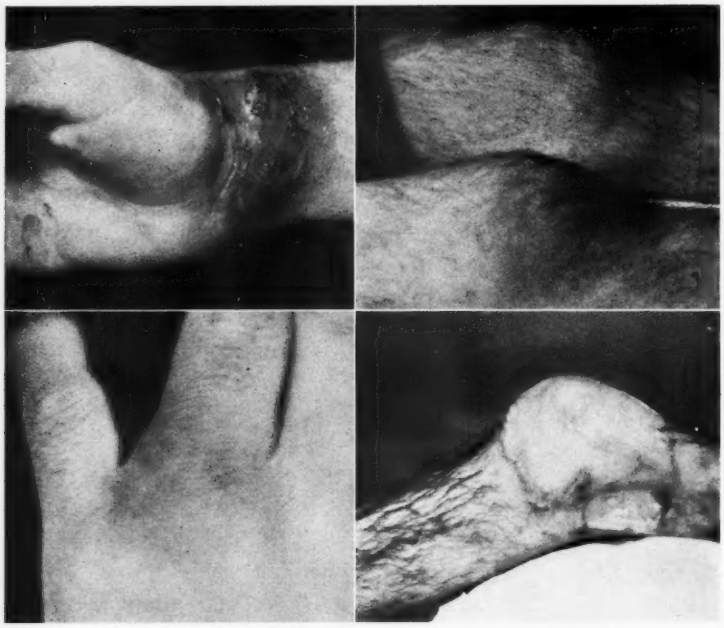

Fig. 1 *(upper left)*. Two pigmented swellings of the flexor surface of the right wrist. One of the swellings has already become ulcerated.
Fig. 2 *(upper right)*. Swelling of the knees during the first months of involvement of the knee joints.
Fig. 3 *(lower left)*. A pigmented swelling over the first metacarpal bone of the left fourth finger which later became ulcerated.
Fig. 4 *(lower right)*. The left knee joint denuded of the covering skin during the latter part of the disease.

Abdomen: The spleen was palpable.

Extremities: On the dorsum of the right hand there was a large, brownish-blue, pigmented area with two ulcers showing well defined borders; from these came a serosanguineous fluid. Anterior to the wrist were two pigmented fluctuant swellings (Fig. 1). Over the dorsum of the right foot there were two irregular ulcers 3 cm. in diameter, the skin about these areas being pigmented and the same thin fluid being present. There were two small swellings

Fig. 5. Abscesses on the scalp.

about the external malleolus. Both knees presented moderate effusion, but no discolorations were noted (Fig. 2).

Laboratory Studies.—The admission blood count was: red blood cells 4,160,000; white blood cells, 11,000; hemoglobin, 80 per cent (Sahli). These lowered slowly until the last count showed red blood cells, 2,600,000; white blood cells, 7,800; hemoglobin, 40 per cent (Sahli).

Smears: Neutrophils 80, eosinophils 2, large lymphocytes 1, small lymphocytes 17 per cent. The bleeding time was two minutes, clotting time, three minutes. The blood Wassermann test was negative. The urine occasionally showed a 1+ albumin and a few white blood cells.

Progress.—The patient was in the hospital seven months, during which time there was a slow but steady progression of the disease with little tendency to remission. There was a gradual loss in strength, appetite, and weight, until a state of extreme emaciation was reached. The patient complained of headaches and joint pains. His temperature remained above normal during the entire course and during later stages reached 104° F. or more. At times a systolic murmur was heard at the base of the heart. The mental status remained unchanged until the later weeks, when he developed delusions of fear.

Locally, lesions developed in succession on the left ankle, left hand (Fig. 3), lower back, right forearm, left wrist, knees (Fig. 4), over the sternum, upper back, scalp (Fig. 5), etc., until the patient was literally riddled with them. It was characteristic that at first a fluctuant swelling appeared which later became pigmented and ruptured unless incised (practically all were). These lesions then continued to drain the serosanguineous fluid which was released. Coincident with each early swelling, X-ray examination always showed typical bony change with rupture of the periosteum, and subcutaneous tissue and skin manifestations. As each individual lesion progressed in size, the skin seemed to "melt" away, leaving large denuded areas.

The treatment consisted of general supportive measures with sedatives and palliatives. Local lesions were widely incised as soon as the first swellings were noted. The knees were aspirated. Wet dressings of 1 per cent copper sulphate and acriflavine were used, and large doses of potassium iodide were given orally and intravenously. Early in the illness one transfusion was given. Weekly neo-arsphenamine was tried. A vaccine was made, but in view of the patient's poor condition it was not administered. X-ray therapy was considered, but in view of the extensiveness of the process, it was considered futile.

ROENTGEN-RAY FINDINGS

At different intervals, X-ray films were made of every bone of the body, but the observed lesions showed no predilection for any part of the skeleton. They were purely destructive throughout the course of the disease and were characterized by the lack of reparative and of periosteal reaction, clear-cut margins, their location in the cortex, lack of osteoporosis, their multiplicity, rapid development, and accompanying sinuses.

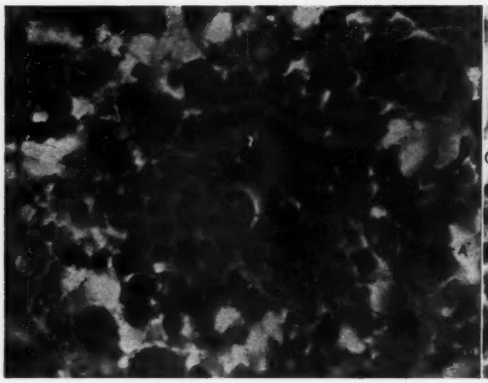

Fig. 6. A larger blastomyces *(A)* is being attacked by leukocytes *(B)*.

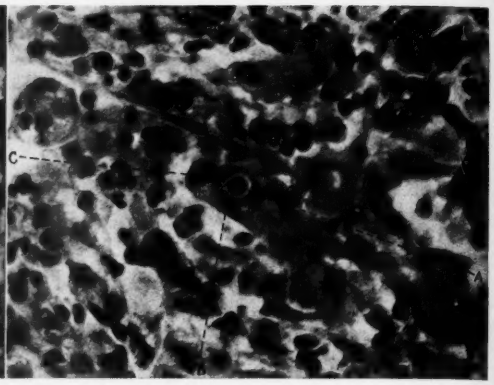

Fig. 7. A smaller budding organism *(A)* is engulfed by a mononuclear phagocytic cell *(B)*. One or two other phagocytic cells *(C)* have joined very closely.

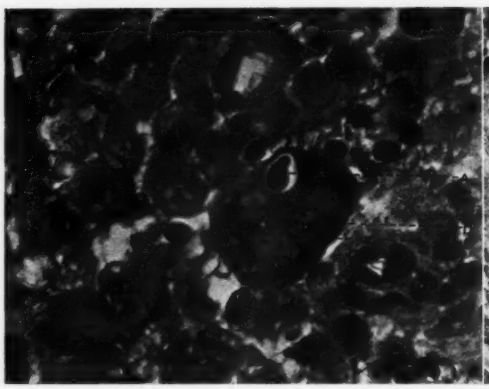

Fig. 8. A budding organism *(A)* in a foreign-body giant cell *(B)*. The border of one of the composing phagocytic cells *(C)* is still suggested.

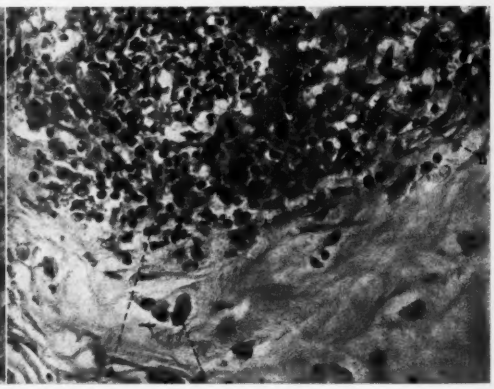

Fig. 9. The edge of an early lesion. Collection of leukocytes *(A)* and large mononuclear cells *(B)*.

Lesions developed in the following bones: multiple lesions of the bones of the vault of the skull (Fig. 13) involving both tables; the right acromion process; medial ends of both clavicles and the manubrium; condyles of the right humerus; upper end and shaft of the right ulna (Fig. 14); styloid process of the right radius (Fig. 15); the lower end and condyles of the left humerus; styloid process of the left radius; the crests of the iliæ; the right greater trochanter; middle third of the left femur (Fig. 16); lower third of the right femur; upper poles of both patellæ; right tibial tuberosity; right medial malleolus; distal ends of both first metatarsals (Fig. 17), and a marginal lesion of the eighth right rib.

In addition to the bone lesions, films of the chest at the time of admission revealed a consolidation of the right upper lobe which had the appearance of lobar pneumonia in an early stage of resolution. This lesion gradually cleared, until the last examination, made shortly before death, showed only a

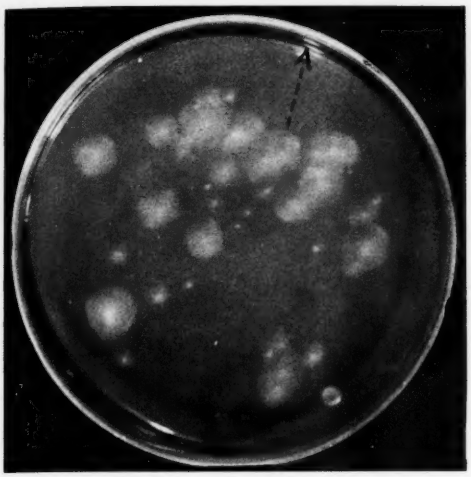

Fig. 10. The colonies of the blastomycetes *(A)* on 2 per cent glucose agar.

few lines of increased density radiating from the right hilum.

BIOPSY

Soon after the patient's admission to the hospital, microscopic examination was done on a biopsy specimen which was obtained from a lesion which was just beginning to break through the skin from below, although the epidermis was still intact. In the corium and the subcutaneous connective tissue there was a lesion composed of numerous dilated blood vessels, delivering abundant polymorphonuclear leukocytes; furthermore hemorrhages, plump mononuclear cells with large, often foamy protoplasm and scattered masses of leukocytes, were disclosed. Blastomycetes, *viz.*, round bodies with highly refractive capsules, were disseminated throughout in moderate number. Their size varied a great deal up to 35 μ in diameter. The large blastomycetes were usually attacked by leukocytes (Fig. 6), while the small forms were taken up into mononuclear phagocytic cells (Fig. 7). Other large phagocytic cells often joined to such a cell and, evidently, by their fusion the foreign body giant cells developed (Fig. 8). Such giant cells were found in a moderate number in this early lesion. Mitotic figures were observed in endothelial cells of blood vessels and in the mononuclear phagocytic cells outside of the vessels. Numerous phagocytic cells were packed with brown pigment granules which gave the iron reaction. This early lesion was not demarcated by a fibrous zone, the edge showing dilated vessels with numerous leukocytes and a gathering of large mononuclear cells in the tissue spaces (Fig. 9).

Examination of a piece of the left iliac bone, removed at operation for an abscess of this region, showed that the bone abscess was walled off by a thin fibrous tissue containing abundant blastomycetes. The organisms were attacked by leukocytes, and minute abscesses were formed in the fibrous tissue. The neighboring bone marrow presented an accumulation of plasma cells and polymorphonuclear leukocytes, but no other remarkable changes. Pieces of bones removed at autopsy from bone lesions showed a similar picture.

BACTERIOLOGIC EXAMINATION

The first cultures were made on March 5 on Sabourraud's media and glucose agar from the open lesions on the right wrist. The colonies of blastomycetes appeared in from two to six days as pin-point sized, round, elevated, grayish spots soon showing radiating filaments. Some colonies were round for several days, bulging very much, firmly adherent, grayish, and only later on developing radiating filaments. As the colonies became older, they grew much larger, becoming one centimeter or more in diameter, and a great number of aerial hyphæ developed, causing a fluffy appearance. The center of the colonies remained prominent (Fig. 10). In glucose broth the growth was sluggish and fermentation was not obtained.

Microscopically the young colonies pre-

sented numerous septate mycelial filaments with true branching. The filaments showed granules. Round bodies could be found but they were scarce (Fig. 11). In old, drying cultures the round bodies with refractile organisms, but lesions could not be detected in any of the organs.

According to the above description, the isolated strain of blastomyces belongs to the non-fermenting type described by Gilchrist

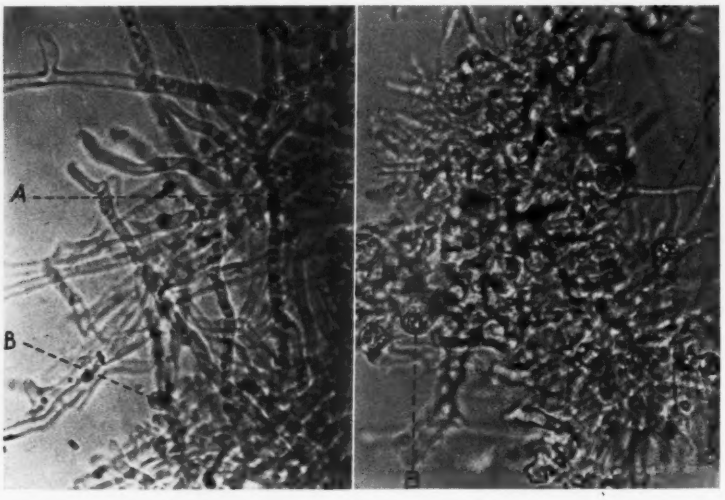

Fig. 11 *(left)*. Microscopic appearance of young colonies of blastomycetes. Numerous septate mycelial filaments *(A)* with true branching. There are only occasional round organisms *(B)*.
Fig. 12 *(right)*. Older colonies under the microscope. There are mycelial filaments *(A)*, but the round bodies *(B)* are abundant.

capsules were abundant (Fig. 12). These drying cultures lost their fluffy character and appeared as velvety white colonies on glucose agar media.

Positive cultures were also obtained from the biopsy specimen and later on from a hip abscess and knee joint fluid. The peculiar brownish-red color and stringy consistency of the pus were noted. According to the histologic examination, the chocolate-brown color of the pus was due to the pigment found in the phagocytic cells. Cultures of blood, spinal fluid, sputum, urine, and feces were repeatedly negative for blastomycetes. The patient raised only a small amount of sputum.

A white mouse and a rabbit were injected subcutaneously and intravenously with a single dose of the emulsified colonies of the

(4). Castellani and Chalmers (2) classify these organisms under the name "oidium."

POSTMORTEM EXAMINATION

An autopsy was performed a few hours after the patient's death on Sept. 18, 1930, with the following findings: The skin of the extremely emaciated young man was pale and wrinkled and there were many ulcers, covered with slough and a greenish discharge. A number of these were located on the scalp. An ulcer was located at the sternal end of the left clavicle and a sinus led from the bone to the surface. There were ulcerated areas over both knees, at the basis of which sinuses opened into the knee joints. The right knee showed two sinuses, one on each side of the patella; the left knee,

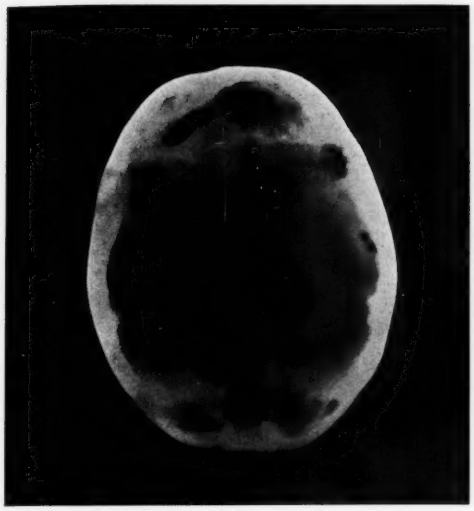

Fig. 13. X-ray film of skull cap showing multiple lesions which involve both tables.

one, on the outer side. The left wrist was ulcerated, especially over the distal end of the ulna, which was denuded of almost all soft-tissue covering except the extensor carpi ulnaris tendon that held it in place. Finally, there was a large ulcer over the sacrum.

The skull cap was perforated by two sinuses, and extensively eroded by a localized necrotic process which attacked the bone from both internal and external surfaces. In the left frontal region, a walnut-sized, extradural abscess was formed. The brain showed a corresponding depression. While the leptomeninges were thin, the brain itself showed no remarkable pathology on the surface or on the numerous frontal sections.

The inner surface of the manubrium sterni was carious, the discharge from this area being carried to the sinus at the sternal end of the left clavicle. The heart showed marked loss of epicardial fat, but otherwise the findings here were negative. The left pleura was smooth and glistening except an area 4 by 10 cm. posterior to the lung root, where the left lung was adherent to the chest wall. Here the left lung was red but still crepitant. On cut section an increased amount of bloody fluid was expressed from this region. There was a small retropleural abscess due to a carious rib at this site. Another abscess was found, more lateral, and on a lower rib. The right pleura was smooth and the right lung was crepitant throughout, but its lower lobe was somewhat edematous. The fifth lumbar and the first sacral vertebræ were carious. The discharge drained posteriorly through a sinus described above.

Histologic examination of autopsy specimens showed areas of peribronchial fibrosis in the upper lobe of the right lung and atrophy, together with passive congestion of the liver. The other organs were not remarkable, except for the anemia and general atrophy. The lymph nodes were negative.

DISCUSSION

Systemic blastomycosis has presented lung lesions in about 90 per cent of the cases and, according to Stober (7), the pathology of the lungs consisted of old bronchopneumonic lesions. In our case X-ray examination of the lung showed a definite shadow which gradually cleared up. Sections of the lung from that region showed fibrosis of the peribronchial tissues and also of the alveolar wall, although no blastomycetes could be found. On the basis of these lung findings and in the absence of other convincing primary foci, we must also assume that probably the lung was the portal of entry of the blastomycetes.

Histologic observation showed that the blastomycetes were not digested either by the leukocytes or by the large phagocytic and the giant cells. It seems probable that the phagocytic cells, having engulfed the organisms, would enter the blood stream and

Fig. 14 *(upper left)*. Showing lesions of shaft and condyles of the humerus.

Fig. 15 *(upper right)*. Right forearm showing lesions in the ulna and the styloid process of the radius.

Fig. 16 *(lower left)*. Showing lesions in the shafts of the femora and the greater trochanter of the right femur.

Fig. 17 *(lower right)*. Antero-posterior film of feet with lesions in the first metatarsals. Note the absence of bone production in all the bone lesions.

the lung would clear up, the remainder being but a slight fibrosis. The living organism would have ample time to multiply if lodged somewhere, especially in the bones. The epiphyseal portions of the bones and the cancellous bone tissue appear to be favorable places for the phagocytized organisms to be easily caught up and retained. Furthermore,

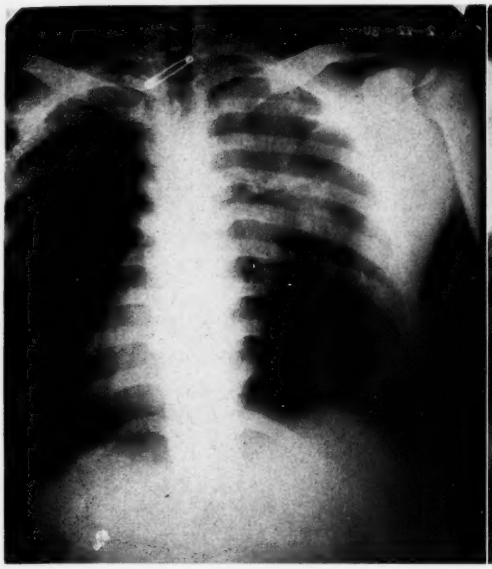

Fig. 18. Chest on admission, the lesion occupying the right upper lobe. The lines of increased density seem to radiate from the hilum and are apparently due to a peribronchial infiltration.

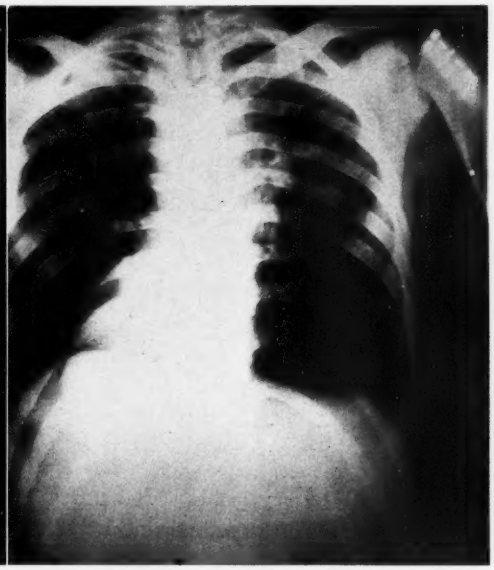

Fig. 19. Film made shortly before death. The lesion of the right upper lobe has practically disappeared.

it seems also probable that the re-infection of the system from a bone lesion may occur and other foci may subsequently develop if demarcation by fibrosis is inadequate. Such a process occurred evidently in our case, for the new lesions appeared at intervals of several weeks. A cutaneous lesion cannot be considered as the primary focus of the infection because it is always associated with bone lesions from which the deeper tissues and the skin became involved. Brain lesions were not found at autopsy, though a few cases have been published in which cerebral and cerebellar abscesses are reported (5). In our case only an extradural abscess was observed as a result of a skull lesion.

Bacteriologic examination of the biopsy specimen and the pus obtained at operations gave positive results. The blastomycetes grew readily on 2 per cent glucose agar plates at room temperature and were usually associated with *Staphylococcus aureus*. The latter was considered as a secondary invader and not as a contaminating organism. Other observers have also found various organisms as secondary invaders (8). The blastomycetes cultivated from the various lesions always showed the same type of growth. The colonies were white and fluffy, due to the abundant aerial hyphæ as long as there was enough moisture in the culture media. As the culture media became rather dry, the aerial hyphæ disappeared, and the colonies turned velvety with a slight light brown hue. These colonies showed only round bodies under the microscope.

Histologically the lesions were different from those caused by the tubercle bacilli. It is not our purpose to consider in detail the histologic characteristics of the blastomycotic lesions. The microscopic picture and the features distinguishing it from tuberculosis were emphasized among other authors by one of us (3) in an article reported else-

where in connection with another case. The histologic finding in the present case substantiates the observations laid down at that time.

We tried to get some idea of the source of infection in this case. The house in which the patient was living appeared to be very unhygienic, but the walls and the floor of the dirty grocery store and the cellar beneath were unsuccessfully searched for molds or fungi. The other members of the family did not show signs of blastomycosis.

BONE LESIONS

One of us (L. R. L.) collaborated in preparing this case report with a view to laying down criteria which would permit the recognition of cases of blastomycosis from the roentgen-ray appearance of the bone lesions.

Potter (6) describes the lesions as occurring most frequently in the long bones near the epiphyses. There is rarefaction and a rather marked periosteal proliferation. The bone surrounding the focus shows little change. He summarizes by saying: "Such a marked localizing destruction occurring within spongy bone of a diaphysis, together with a mature and homogeneous periosteal proliferation with or without cloaca, is so constantly present in the ordinary lesions of blastomycosis that when seen in further skiographs where the etiology has not been determined, a careful search for blastomyces should be made."

Carter (1), in a very excellent review of coccidioidal granuloma, summarizes by saying: "The resemblance to blastomycosis is greater than to tuberculosis and distinction would seem difficult if not impossible." He lists lesions of the bony prominences such as the poles of the patella, acromion or coracoid processes or angles of the scapula, olecranon or styloid processes of the ulna, styloid processes of the radius, condyles of the humerus, extremities of the clavicles, of the malleoli, tuberosity of the tibia, solitary marginal lesions of the ribs, localized destructive lesions of the outer table of the skull, and destructive lesions of the various parts of the vertebræ as being distinctive of coccidioidal granuloma.

Considering the data of the literature from the radiologist's point of view, the bone lesions of this case resemble coccidioidal granuloma more than they do blastomycosis. Nevertheless, the bacteriologic examination revealed typical blastomycetes; therefore, we are led to the same conclusion as Carter (1), cited previously.

It seems possible, however, to differentiate with the X-ray purulent and tuberculous osteomyelitis and metastatic bone tumors from bone lesions caused by *Coccidioides immitis* and blastomycetes, thus establishing a correct early diagnosis of the latter diseases.

TREATMENT

Concerning the treatment of generalized blastomycosis, our case will only increase the number of those which ended fatally, as is the usual outcome of the systemic disease. The mortality is nearly 100 per cent. In our case, oral and intravenous potassium iodide and neo-arsphenamine evidently had no effect. It seems to us that the constantly good appetite of the patient and the evacuation of abscesses with the applied local treatment were more important. We have to admit, though, that while treatment served to prolong life, it did not prevent extreme emaciation and the development of other foci. Death occurred in extreme exhaustion.

SUMMARY

1. A case of systemic blastomycosis is reported in a white male who had spent his entire life in New York State.

2. The disease was characterized by

multiple bone lesions which later involved the soft tissues above the bone and ulcers of different sizes developed.

3. Blastomycetes were found in the lesions culturally and histologically. The diagnosis of systemic blastomycosis was established after a few weeks of hospitalization of the patient.

4. Characteristics of the isolated strain of blastomycetes and the histology of the early lesions are described.

5. X-ray appearances of the bone lesions are given and the possibility of differentiating blastomycosis and coccidioidal granuloma from other bone lesions is considered.

6. The primary focus of infection was considered to be in the right lung. This consideration was supported by X-ray findings, though toward the end of the patient's life the lung cleared and blastomycetes could not be detected in sections of the lung.

7. The various forms of treatment were unsuccessful.

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New Camera Records Stages of Ear Disease.—The interior of the human ear can now be photographed with a new camera developed by Dr. Richard Millar, director of the photography division of the Methodist Hospital of Indianapolis. The ear camera is hailed by the medical world as a distinct step forward in the treatment of ear diseases. For the first time in medical history a pictorial record of different stages of ear diseases can now be kept.

The camera takes pictures 120 times as large as the inner ear. With the use of a special concave mirror, a powerful beam of cold light is focused ingeniously into the patient's ear. The exposure is made through a hole in the center of the reflecting mirror which is turned to deflect the light from the lens of the camera. Heat is extracted from the light beam by passing it through a flat glass flask filled with ice water before it reaches the ear. A clever ground glass arrangement fitted into the side of the camera enables the surgeon taking photographs of the inside of an ear to see the image which is passing through the camera lens even when he is operating the shutter. Thus he can see exactly the image that falls on the plate or film.

Dr. Millar is now at work on a camera which will take the picture of the back of the eye. He predicted that soon a camera will be developed to photograph the inside of the human head from the inside.—*Science Service.*

FURTHER OBSERVATIONS ON HIGH MILLIAMPERAGE TECHNIC[1]

By JOHN D. LAWSON, M.D., and EARL H. GRAY, M.D.

From the Department of Radiology, Woodland Clinic, WOODLAND, CALIFORNIA

CONSISTENT duplication of radiographic results may be accomplished only when the factors entering into the exposure are subjected to absolute and accurate control and precision. The necessity for this precision is most pronounced when high milliamperage exposures for a short time are utilized. In a previous article on this subject,[2] one of us (J. D. L.) endeavored to outline the advantages of a technic for chest study embodying high energies for a short-time period.

In an attempt to give this type of radiography the status which we believe it should have, considerable experimental study is being devoted to this subject in the Woodland Clinic Laboratory, the source of these articles. Several important phases will be considered in subsequent communications.

Unless it is possible to give definite factors which will, on all types of equipment, produce the same results, we have not assisted radiology in the solution of a problem, nor have we contributed to the popularization of that technic which seems in our mind to have great advantages.

In this presentation we desire to focus attention particularly on the difficulties, which are brought about by mechanical inaccuracies, surrounding work in the high milliamperage field. We refer especially to the measurement of time, milliamperage, and kilovoltage.

Control of the time factor to a minute fraction of a second may now be accomplished by means of the synchronous timer which makes and breaks at zero potential, and times varying from 1/120 to ¼ second may be accurately and consistently obtained. Previous to the use of this timer, we worked with three ordinary motor-driven timers, none of which could be regulated in any way to approximate consistent duplication. In none of these was an exposure of less than 1/20 second obtainable.

All timers have been checked through the use of the spinning top with a small punch hole in the periphery, giving a recorded proof of the number of electric cycles during which the tube was energized. In this paper we will speak of time in terms of half-cycles, or alternations.

All observations have been made on a four-valve rectified unit with a primary current of 240 volts drawn from a 30 K.W. transformer through 120 feet of 000 copper wire. The same tube, a broad focus universal, has been used throughout. Milliamperages were recorded on two ordinary and one ballistic milliampere meters in series.

Kilovoltages were recorded on a 12.5 cm. sphere gap which had previously been calibrated by means of a spectroscope and corrected for temperature, barometric pressure, and humidity. A ballast tube was used in shunt to protect the valves when using the sphere gap.

Until recently, the reading of milliamperage has been confined to the use of a standard milliampere meter which necessitates that energy be applied for at least one second before stabilization of current is reached. This length of time must elapse before the forces of inertia and momentum are overcome and an accurate reading may be obtained. However, in the ballistic mil-

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1 to 5, 1930.

[2]Lawson, John D.: High Milliamperage Technic. RADIOLOGY, November, 1930, XV, 575-578.

liampere meter we have an instrument reading directly the milliampere time product consistently and accurately for times as short as one-half cycle and up to one second. This, when used in conjunction with an accurate timer, will allow for the exact computation of current flowing and is the basis for the interesting determinations we have made.

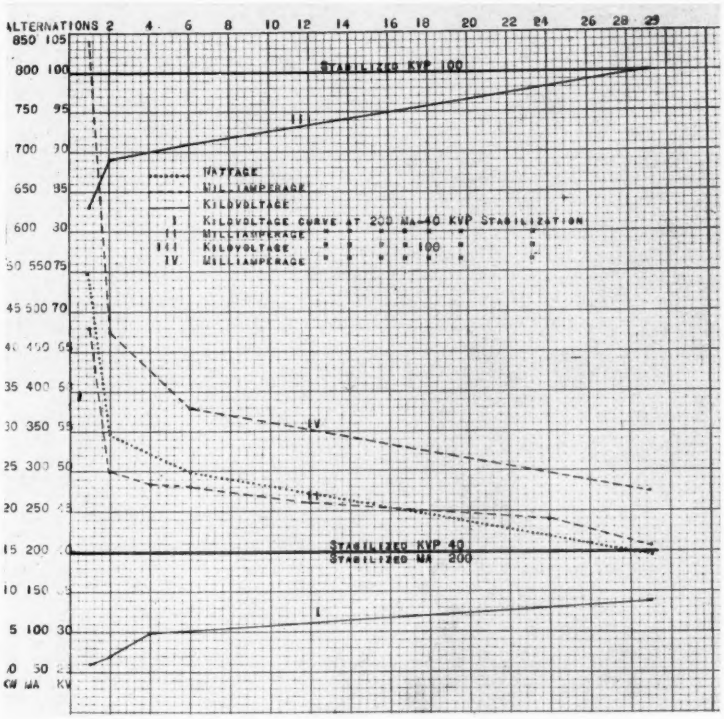


Chart I.

Using the materials described, observations have shown that variations of more than 400 per cent are common in milliamperage and that detection of this variation is impossible except with the ballistic meter. With the Coolidge filament set at the proper point to allow a 200 ma. stabilized current to flow through the tube, our data prove that 840 ma. were actually flowing when this tube was energized for one alternation. This value rapidly decreased as the time lengthened and eventually reached the mean value of 200 ma. for sustained exposure. It was noted that the milliamperage decreased as the kilovoltage was decreased below the saturation point of the tube, which in our case was 74 K.V.P. at 200 milliamperes.

Conversely, we find, when energizing the tube under the above conditions, a minimal kilovoltage reading occurs which follows an inverse curve to that observed in the case of the current. A stabilized value of 40 K.V.P. is reduced to 27 K.V.P. for an exposure of one-half cycle. As the time is increased, this value gradually approximates the predetermined sustained kilovoltage.

The difficulties produced by these phenomena are great, as there is neither a stabilized kilovoltage value nor a consistent

current flowing for the first 30 alternations. True, the calibration of any machine may be accomplished and results be duplicated, but to expect the results obtained on one unit to be applicable to another will certainly meet with disappointment.

Calibration of a mechanically rectified unit, while not complete, seems to indicate that it also shows a marked variation in kilovoltage and milliamperage but the curves will vary considerably from those obtained on the valve equipment.

It is the intent of the writers to attempt to clarify, in further articles on the subject, the many questions which are brought to the surface in this paper. The exact bearing and relation of surges, transformers, capacity of primary line, individual rectifying variations, type of rectified wave, and many other factors must be considered before final judgment is formed.

It is in order, however, in view of the information at hand, to state that, without accurate timing and measurement of milliamperage through use of the ballistic milliampere meter and careful determination of the kilovoltage factor, no satisfactory work may be accomplished in the high current field. All other factors remaining the same, careful and accurate calibration of equipment will permit of reduplication of results and accomplish the desired effects.

DISCUSSION

Dr. John R. Carty (New York City): I cannot add much to the discussion of Dr. Hunsberger's paper (see p. 320). We adhere to a standard technic, deviating only when special occasion arises, which in our experience has been rather infrequent.

As regards Dr. Lawson's paper, I wish to commend him for his painstaking work in developing high powered radiography. As a result of the increasing interest in speed radiography many undoubtedly will install suitable apparatus. Unless, however, there is a thorough comprehension and consideration of all the known factors there will be many costly disappointments and fast radiography will suffer condemnation. For instance, if the primary source of current is not adequate the results will be extremely poor. Installations of high powered radiographic apparatus have been made, only to find that the source of current is unsatisfactory, necessitating expensive alterations. I feel that there is a great future in this type of work as motion during exposure is one of the greatest enemies we have to contend with in producing satisfactory radiographs.

Dr. Lawson (closing): When we had completed our study, Dr. Gray remarked, "You know, it seems a rather unsatisfactory proposition to present work which contains a great deal of destructive criticism without having anything of a constructive nature attached to it." It was Dr. Gray's idea that this work was almost entirely destructive, but, after reviewing material which has been presented, I believe the morals which may be drawn from it are such that the facts presented must be considered as constructive in nature inasmuch as we have called to the attention of radiologists that we have in the past been working with unknown factors. Our timers have been inaccurate, the exact amount of current which is flowing during a short interval could not be estimated, and kilovoltage determinations have not been made as frequently as possible. One laboratory can reduplicate the results of another laboratory, providing the two laboratories speak the same language or have their equipment calibrated accurately so that the units are interchangeable, and when it is possible to have one laboratory indicate a type of exposure to be instituted in a similar institution two thousand miles away, and be assured of a satisfactory result, we feel that considerable has been accomplished. A primary hindrance in radiographic work has been inadequacy of equipment, or, one might say, the lack of satisfactory measuring apparatus. There have been certain mechanical and electrical developments within the past year, which, when commercial-

ly applied, have assisted greatly. We may now measure kilovoltage and milliamperage accurately even for a period of 1/120th of a second, which time may also be accurately obtained. It is a rather expensive procedure to calibrate machines, but, of course, more expensive to develop the various defects which have been carried through the years of radiological development. However, once these points are eliminated, which they will be one by one, we feel that it will become possible for the standard technical set-up to be used universally. A continuation of the work on this subject will probably produce many other observations which have bearing on the subject presented herewith.

CANCER CLINICS DECLARED OF GREAT COMMUNITY VALUE

If a cancer clinic can be made popular in a community it will tend to keep patients from going to cultists and charlatans, is the opinion of Edward J. Klopp, M.D., of Philadelphia, who discussed the advantages and organization of such clinics at the meeting of the American College of Surgeons.

"The patient receives careful consideration, good advice and the best treatment the hospital of the community affords," Dr. Klopp said.

The staff of such a clinic in the general hospital of a large city should include specialists in surgery, in pathology for examination of tissues to determine whether or not they are cancerous, in X-ray work, in radium and electrical treatments, in internal medicine, synecology, skin diseases, urology, ear, nose, and throat diseases, a bronchoscopist, a chemist, a social service worker, and stenographic and technical assistants, according to Dr. Klopp's outline.

If there is opposition to the formation of a cancer clinic, it can be established purely for consultation and follow-up work, Channing C. Simmons, M.D., of Boston, pointed out in discussing the tumor clinic of the Massachusetts General Hospital.

"A hospital is established primarily for the treatment of the sick. It is necessary to prove to the trustees and staff by the work of its members that the treatment advocated by the cancer clinic gives a larger percentage of cures in the early cases and a longer span of life in the hopeless cases," Dr. Simmons said.—*Science Service.*

ADAPTATION OF TECHNICS TO INDIVIDUAL CASES

SOME SPECIAL VIEWS THAT HAVE PROVED VALUABLE[1]

By HARVEY S. HUNSBERGER, M.D., San Francisco

THE difficulty of accurate fracture diagnosis was first forcibly impressed on me by a case of fracture of the os calcis. Clinically the ankle was suspected, but the usual ankle films were negative. Next, request was made for films of the os calcis. Satisfactory views, both lateral and vertical, were negative. Films of the metatarsals were then requested, but the metatarsals showed no fracture. However, the oblique view of the metatarsals showed very clearly a transverse fracture ½ inch deep in the anterior articular surface of the os calcis. In this case, only *one film out of seven showed the fracture,* and that film was made for the study of an entirely different part.

In general, more fractures will be demonstrated, and doubtful fractures will be made clear, if the part suspected clinically or after an examination of preliminary films is brought as close as possible to the plate. In many instances, this may necessitate a departure from routine or standard positions. For instance, in making special views of the carpal trapezium (os multangulum majus) dental films were used. The wrist was so rotated that the lateral border of the trapezium, where the fracture was suspected, was brought close to the small film. The dental negative demonstrated the fracture clearly, but the usual views of the wrist, though of good technical quality, did not show the lesion clearly enough to permit a positive diagnosis.

The principle above stated has its application to the foot. In the routine examination of the foot, three views are usually included, the anteroposterior or vertical, the oblique, and the lateral. In all of these views, however, the posterior ends of the first three metatarsals are considerably removed from the plate, owing to the upward convexity of the longitudinal arch of the foot. This is also true of several of the tarsal bones, notably the scaphoid and the three cuneiform bones. When a lesion of any of these bones, or of their joints, is suspected, it is important to take postero-anterior views. The patient is placed prone, with the foot in extreme dorsiflexion on an angle board, the ankle being higher than the toes. The tube is tilted about 15 degrees from the perpendicular toward the head, being centered over the bases of the metatarsals. The following case illustrates the importance of this view.

W. K. came to the laboratory Aug. 29, 1930, for examination of the left foot and ankle. The following report, in part, was rendered: "No important fracture of the bones of the left foot or ankle can be made out. There is a small, irregular fragment of bone lateral to the base of the first metatarsal that may have been separated by a crushing fracture. This is not certain. If the matter is of sufficient clinical importance, further light might be shed by special views, but it is possible that such views might not furnish a definite answer to the question."

On Sept. 15, 1930, the patient returned for additional studies, and the following report was made: "Special views of the left foot designed to bring out detail at the bases of the first to third metatarsals, with similar views of the normal foot for comparison show . . . a fracture of the base of the third metatarsal in the horizontal plane, separating a fragment 1.5 cm. long. The fracture involves the joint."

If the technic had not been adapted to

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1–5, 1930.

suit the requirements of this case, a minor fracture would have been inconclusively shown, and an important fracture would have been completely missed.

In cases in which full extension of the elbow is not possible, the same principle requires that two anteroposterior views of the elbow be made. One view should be taken with the condyles of the humerus as close as possible to the plate, and one view with the head of the radius as close as possible to the plate. According to my experience, fractures of the head of the radius are among those most likely to be missed, hence the greater need of the two anteroposterior views in the circumstances mentioned.

In skull examinations, by adapting the technic, a fracture may be demonstrated the existence of which would otherwise not be suspected. This was first shown to me by a hospital case in which routine stereoscopic views of the skull in four directions were pronounced negative by a competent roentgenologist. The interne on the case was astonished at the negative findings. In viewing the films, he pointed to a very faint line in the region where, clinically, he had every reason to suspect fracture. The line certainly bore no resemblance to the ordinary fracture line, and he who diagnosed it as such would certainly have been rash. At my suggestion, we had the patient return to the X-ray laboratory, where we placed the suspected area directly upon the plate and took an oblique view. The result was a fracture line that stood out so clearly no one could question it. Even the technician could see it plainly on the wet film. The oblique view of the skull showed a long vertical fracture of the posterior part of the parietal bone, which was not shown in the stereoscopic lateral projection.

In addition to closeness of the fracture to the plate, a second factor of great importance is the direction of the ray with relation to the line of fracture. If the central ray is parallel to the line of fracture, or nearly so, the fracture is likely to be registered on the plate; if not, it may be missed. As fractures may occur in any plane, the greater the number of directions from which the ray strikes the suspected part, the greater the number of fractures that will be shown. In practice, this means that the part should be placed in as many different positions as possible, or practicable, for exposures. In a series of 1,035 fractures encountered in the X-ray Department of the United States Marine Hospital, San Francisco, 36, or 3.5 per cent, were recorded as being shown in only a single view. In all these cases the examination included three or more views. If only anteroposterior and lateral views had been made, these fractures would have been missed.

The routine examination of the wrist, in the majority of laboratories, includes three views, the anteroposterior, the lateral, and the oblique. If any of these is omitted, numerous fractures will be missed. In the ankle, the oblique view is especially well adapted to show fractures through the posterior portion of the articular end of the tibia, the so-called Cotton fractures, which frequently accompany fractures of the malleoli, or of the distal ends of the tibia and fibula. Cotton fractures are usually vertical, involve the joint, and are accompanied by no displacement. Many of them are missed in the lateral view, but, since the accompanying fractures are usually shown, perhaps no great harm is done. In a certain percentage of cases, however, a Cotton fracture, unaccompanied by any other fracture, will occur in such a plane that it can be shown only by the oblique view.

As the bones of the shoulder girdle, with their processes, extend in so many different planes it could hardly be expected that routine stereoscopic views in only one direction would show every fracture. Nevertheless, it required the following case to teach me this fact.

The surgeon in charge of the out-patient

department of a hospital requested X-rays of a patient's shoulder, suspecting fracture of the clavicle. The usual stereoscopic anteroposterior views were negative. The surgeon could not understand this, as he felt both crepitation and movement. Review of the films, which were technically satisfactory, disclosed no fracture to the surgeon or the roentgenologist. The clavicle appeared perfectly normal. The patient, however, was returned to the laboratory, and a postero-anterior projection was made. This view showed an unmistakable fracture of the clavicle, some separation of the fragments.

Fractures of the scapula undoubtedly fail to show in the anteroposterior view more frequently than any other fractures about the shoulder. If the arm is elevated in a special anteroposterior view, fractures of the axillary border of the scapula will be found that would otherwise be missed. Even this view may fail to show a fracture of the axillary border, which may be seen only in the anterior projection. Since I have discovered that a fracture of the spine of the scapula also may fail to manifest itself except in the anterior projection, an anterior projection of the shoulder is part of the routine examination in the laboratories of which I have charge.

Fractures of the acromion process of the scapula near its tip are common. Since the anterior end of this process lies almost in the coronal plane, such fractures are not easily seen. Special anterior projections, made with the shoulder on an angle board tilted toward the head and toward the feet, respectively, and with the tube tilted about 10 degrees toward the head or toward the feet to correspond, may aid in demonstrating these fractures.

From stereoscopic views, one gains a more accurate perception of relations. When the relations are complicated, as in the numerous bones of the wrist and foot, and in the astragalocalcaneal joint with its irregularities, stereoscopic views, with similar views of the normal part in exactly the same position, for comparison, will often clear up a difficult fracture. Such views are also valuable in detecting minor degrees of dislocation, especially of the carpal bones, which are otherwise virtually beyond detection.

SUMMARY

Routine radiograms sometimes fail to reveal fractures that are present. Special views sometimes do reveal them. In making special views, the part should be brought as close to the film as possible and projections made from as many different angles as possible.

DISCUSSION

DR. ROBERT S. STONE (San Francisco): I think that a paper such as Dr. Hunsberger's should be presented before an audience not exclusively of radiologists. Our excuse for existing as roentgenologists on fracture work lies in the very point Dr. Hunsberger has brought out. If we are going to be merely technicians, taking only anteroposterior and lateral views of the cases that are sent in to us and reading only those views, then the average surgeon dealing with fracture work can handle the case just as well, or better, than we can. Our reason for existence in fracture cases is that we understand the principles of projection of these different fracture lines and on a great many of the cases that come to us we must use other than routine views to arrive at a diagnosis. Our medical training and special X-ray training have to be adapted to this work, and it is our sole excuse for being specialists in this field. I should certainly like to see a paper of the type of Dr. Hunsberger's put before the surgical section of the American Medical Association or some other general meetings so that others may realize the detection of even fractures is not so simple as a great many general men consider it.

DR. D. M. GHRIST (Glendale, Calif.): This paper brings up a point which I believe should be mentioned here. We are often unable to collect payment for the number of films necessary to arrive at the proper diagnosis, and the insurance companies frequently object to multiple exposures for the detection of injuries in cases in which fractures are suspected.

I remember being at the San Diego meeting in the Radiologic Section a year ago last summer at which one of the members of the Industrial Commission told the Radiologic Section that we were supposed to have a right to demand a sufficient number of exposures to arrive at an intelligent diagnosis. He further stated that the Industrial Commission would no doubt bear us out in a reasonable number of exposures.

On two or three occasions I have received letters from the attorneys for the industrial insurance companies, stating that they had reduced the bills because of unnecessary exposures, and were inclosing checks for the amounts which in their judgment were correct.

In one such instance, my very resourceful secretary defeated this encroachment by writing the attorney that the charges and the exposures were those which were regularly routine as recommended by the Industrial Commission, and, since our charges were correct, we would hold the check until such time as he saw fit to send the balance due. We later received another letter indicating failure of the attorney to understand. We wrote in detail, explaining the necessity of the total work done, and mentioning the rulings of the Industrial Commission in these cases. We further offered to interview personally the attorney to explain the necessity and nature of the work. If the attorney was still unconvinced regarding the matter, we advised him that we would arrange for a hearing by the Industrial Commission. The correspondence convinced this attorney without his even coming to see me and without any further trouble whatever.

Now, whether he was convinced by my explanation or whether he thought he would see the light when he got before the Industrial Commission I do not know, but it is necessary for the radiologist to emphasize the importance of his position. Even if one has to go to the expense of bringing some of these attorneys to a hearing before the Industrial Commission, I feel it should be done. All the money that the attorneys for an insurance company can divert from the roentgenologists' fees may accumulate to an amount sufficient to impress the company directors with their attorney's worth, but it appeals to me as being very unfair to us. I merely relate this as a system which I have developed during a good many years in working for industrial insurance companies, and I find that, after they are brought to a full understanding, the difficulty is soon eradicated. If we, as radiologists, will stand upon our rights and follow this matter through to the proper settling of affairs, it will not pay us personally from the standpoint of dollars and cents, but many individual efforts toward bringing the light to these people will benefit the whole radiologic association.

DR. HUNSBERGER (closing): Perhaps I shall take Dr. Stone's suggestion and present this matter to the surgeons at some meeting. Of course, the entire point of the paper is that the diagnosis of fracture is far from a simple matter.

CLINICAL AND THERAPEUTIC CONSIDERATION OF OSTEITIS DEFORMANS[1]

By WEBSTER W. BELDEN, M.D.,[2] and ALICE R. BERNHEIM, M.D.,
New York Hospital, New York City

THIS rare and interesting condition, the exact nature of which is still unknown, was first described by Sir James Paget in 1876. It begins usually after the age of 40. The youngest case that the authors have been able to find reported is that of a patient in Dr. LeWald's series who was 31 years of age when the disease was first noted.

The essential feature of the disease is an associated softening and overgrowth of bone, with persistent bone pains forming the chief subjective symptom in the earlier stages. As to clinical features, the bones principally affected are the skull, the vertebræ, and the bones of the leg, but almost any bone may be involved. As a rule the disease manifests itself in a number of bones, but in rare cases it may be confined to one, the diagnosis being then a matter of great difficulty. The bones of the lower limbs are usually the first to be affected, but in a number of cases the disease has been known to commence in the skull. The softened bones of the leg, having to bear the weight of the body, become bent; the femur bends outward, the tibia forward. The patient, therefore, becomes bow-legged. In addition to the bowing there may be a marked twisting, so that, as DaCosta remarks, "The femur comes to look as though it had been grasped by the hands of a giant, bent into a bow, then twisted."

Other factors, in addition to that of body weight, must be responsible for the deformity, for the bones of the arm also become bent, although to a lesser degree. In this case the curve is backward. Associated with the bending, or even before it occurs, there is a characteristic thickening of the bone. The bone pains, which are so constant a feature of the disease, are felt particularly in the legs, seldom in the arms or head. They may be continuous or periodic and may appear many months before any gross lesion can be detected.

Enlargement of the skull is almost always present at some stage of the disease. It may be the first sign to appear, and may attract attention through the patient noticing that he has to buy hats of ever-increasing size. The deformity in typical cases is so characteristic that it can be recognized at a glance. The head becomes a triangle, with the base above, the face usually escaping almost completely. The enlargement is due to an enormous deposit of bone on the outside of the cranium; there is no endocranial thickening. To those cases in which the facial bones and the bones of the skull are thickened whilst the other bones escape, the name "leontiasis ossea" is given.

The vertebral column is almost always involved, and marked kyphosis develops in the dorsal and lower cervical regions. As a result of the kyphosis, the patient shrinks in height, a condition which is aggravated by the bowing of the legs. There are cases in which a man has lost as much as a foot in stature.

The clavicles may be affected, and, in exceptional cases, the bones of the hands and feet. The pelvis may be broadened, the ribs thickened, and the chest deformed.

The X-ray examinations show characteristic changes long before any deformity appears. There is great thickening and in-

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1–5, 1930.

[2]Doctor Belden died shortly after presenting this paper before the Radiological Society. John Remer, M.D., his friend and associate, read the manuscript with the purpose of carrying out any changes which Dr. Belden might have made.

crease in the density of the bone, and the vault of the skull presents a peculiar serrated appearance. An X-ray examination should be made of all patients with chronic bone pains.

In the advanced stages the appearance and gait of the patient are highly characteristic. The short squat figure with bent shoulders, curved back, sunken chest, long arms, and great head hanging forward, waddles along with bowed legs, out-turned toes and the aid of a stick, the living justification for the term "osteitis deformans."

Although this disease is slowly progressive, it may not shorten life, and is compatible with unimpaired mental activity.

The etiology of Paget's disease of the bone is unknown. Paget, himself, regarded it as a chronic inflammatory condition. French workers consider that it is a late manifestation of syphilis, congenital or acquired. In this age it is only natural that the opinion should be expressed that the condition is due to disorder of the ductless glands. The undoubted relation of the pituitary gland to acromegaly lends considerable support to this view. Hawk has demonstrated metabolic changes of importance. There is a marked retention of calcium, magnesium, and phosphorus, and a large elimination of sulphur. As calcification proceeds, the sulphur is replaced by calcium, magnesium, and phosphorus, being then excreted in the urine.

Since it is a disease of advancing life, there is no question of disturbance of ossification along the epiphyseal line. Instead, the condition is one concerned with extensive resorption of the normal bone by osteoclasts and the excessive new formation by the osteoblasts of irregular bony lamellæ which accompany the fibrous marrow. The marrow actually loses its blood-forming elements, becoming converted into a vascular fibrous tissue which produces much soft, bone-like tissue.

The architecture of the bone is disorganized, and the cortex loses its dense character and sharp outline. The marrow cavity is encroached upon until it is filled completely, a thick subperiosteal layer being formed. In this new tissue the lamellæ run in every direction and occasionally there are cysts or spaces filled with fluid, or tumor-like growths may appear.

In the early stages of the disease the bones are so soft that they can be cut with a knife, but later they may become extremely hard. As already indicated, the essence of the disease is bone absorption, associated with, or followed by, increased bone formation. The bone absorption leads to great enlargement of the haversian canals.

In Paget's original specimens there were innumerable apertures for vessels, and the whole skull was finely porous. Cole, in a recent paper on the pathology of Paget's disease, lays great stress on the vascular changes in a case which he examined. The vessels in the bones showed varicosity, thrombosis, congestion, hemorrhage, and leakage with edema. Cole says, "My impression is that we have a primary blood vessel pathology such as one sees in syphilis, hereditary or acquired, with accompanying bone changes." The vascular lesions he considers infectious in origin.

Absorption is followed by the formation of new osteoid tissue, soft and pliable at first, but later becoming rigid through the deposition of lime salts. The new bone is chiefly deposited from the periosteum, but a slight deposit may take place from the medulla. The medullary cavity becomes obliterated, although not by the formation of any dense bone, and is filled with a vascular fibrous tissue which may produce soft osteoid tissue. The diploë of the skull disappears and the distinction between the outer and inner tables is lost.

Paget's disease is a strong predisposing cause towards the development of sarcoma

of bone, which has occurred in nearly 10 per cent of the recorded cases.

We are becoming more convinced that this group of bone diseases has some relation to metabolic unbalance governed by the ductless glands, the gland which is probably responsible being the parathyroid. This seems rather definitely established in osteomalacia but is still a moot point in regard to osteitis deformans and generalized osteitis fibrosa cystica.

It seems appropriate to state here that the localized form of osteitis fibrosa cystica does not belong in the same class as the generalized type described by von Recklinghausen. The consensus of opinion to-day seems to indicate that the localized form is a chronic non-suppurative osteomyelitis, with which theory we are heartily in accord, with the exception that we do not feel that it is to be classed with the non-suppurative sclerosing type of osteomyelitis as described by Garré. To substantiate this claim we rely on the appearance of the lesions in the radiographs. In the former, the X-ray appearance is very much like the generalized form of osteitis fibrosa cystica and osteitis deformans, but it does not show the dense ivory-like appearance so characteristic of the sclerosing osteomyelitis of Garré.

A differential diagnosis among localized osteitis fibrosa cystica, the generalized form, and Paget's disease is often of the utmost difficulty. We are still of the opinion that generalized osteitis fibrosa cystica and osteitis deformans are different manifestations of the same disease at different age-periods of life, but, as stated above, we feel that the localized form of osteitis deformans is due to a previous infection which causes a sterile non-suppurative osteomyelitis or osteitis.

When one enters upon the discussion of the therapy of osteitis deformans, or Paget's disease, and reviews the literature on this subject, it is found that practically all the drugs included in both the American and British pharmacopeia have been used from time to time. For the past few years at the New York Hospital we have been treating these cases by the administration of calcium lactate, Vitamin D (viosterol), and tomato juice.

The following is the description of the theory and detail of the therapy used.

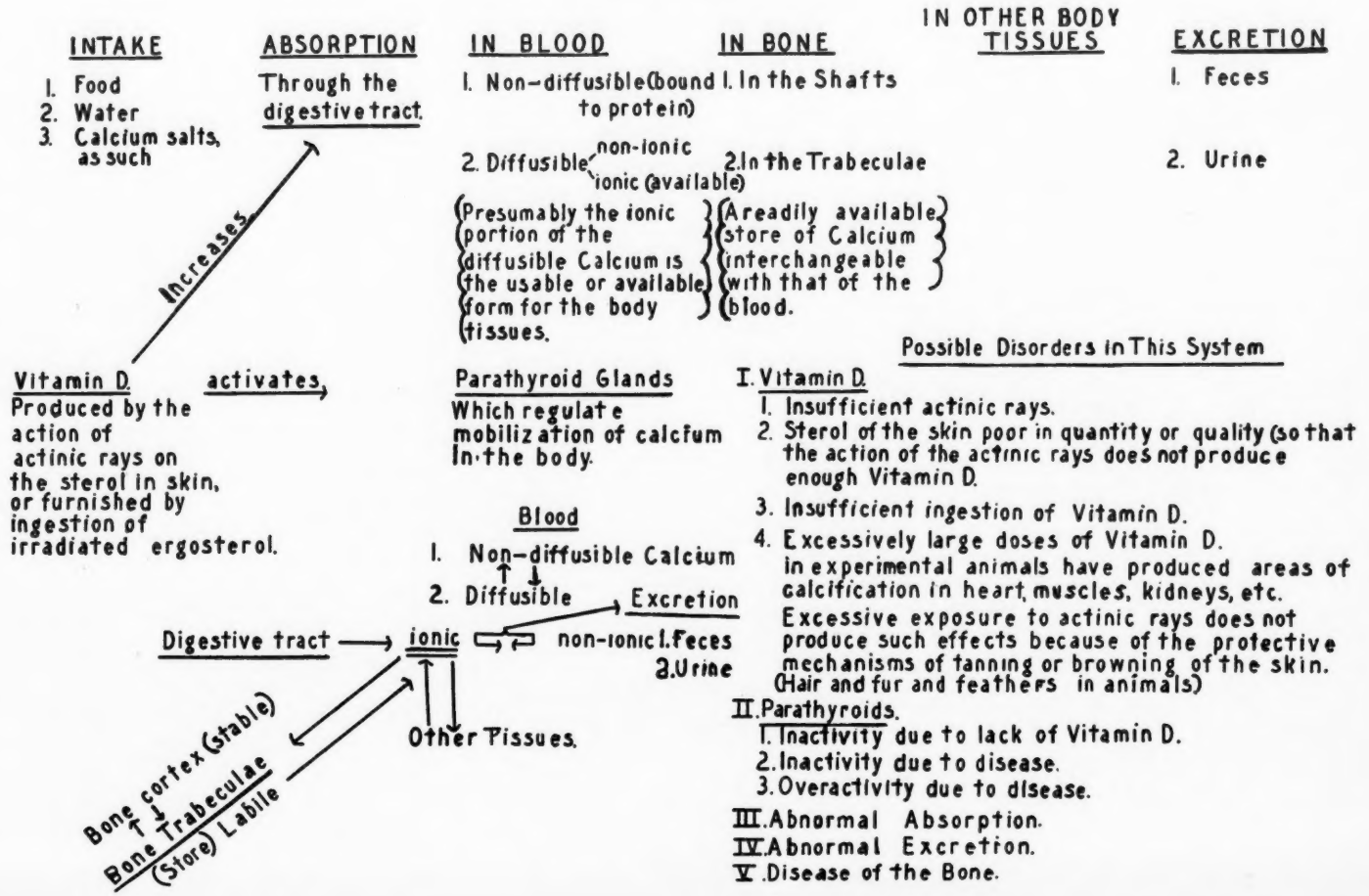
One of us (A. R. B.) has been particularly interested in the question of calcium metabolism and feels that the study of calcium, especially in its relation to the parathyroid glands, may be helpful in an attempt to gain an insight into the nature of these disorders. Observations have resulted in the development of a concept of the subject which may be stated as follows:

The parathyroid glands are mobilizers of calcium. One function of these glands is to control the stream of calcium from the trabeculæ of the bones to the blood. The blood depends upon this supply for its normal concentration of calcium, and not upon the supply absorbed through the intestines, which is a very variable factor. Bauer and Aub have shown that on a low calcium intake of 300 mg. over a three-day period, 790 mg. are excreted, giving a negative balance of 490 mg. of calcium. This may be considered the measure of endogenous calcium metabolism. It is interesting to note that no other inorganic substance behaves in this way.

Over-activity of the parathyroids, as in osteomalacia, increases the flow of calcium from the bones with a resulting osteoporosis, increased blood calcium, and increased excretion of calcium. When the glands are under-active, as in tetany, the output from the bones is lessened, and there is hypocalcemia and diminished excretion of calcium.

Another factor of importance in the calcium chemistry of the body is Vitamin D, of which there are two sources. The action of actinic rays on the sterol in the skin produces Vitamin D in the body, and it may be obtained by the ingestion of irradiated er-

CALCIUM



Possible Disorders in This System

I. Vitamin D.
1. Insufficient actinic rays.
2. Sterol of the skin poor in quantity or quality (so that the action of the actinic rays does not produce enough Vitamin D.
3. Insufficient ingestion of Vitamin D.
4. Excessively large doses of Vitamin D. in experimental animals have produced areas of calcification in heart, muscles, kidneys, etc.
Excessive exposure to actinic rays does not produce such effects because of the protective mechanisms of tanning or browning of the skin. (Hair and fur and feathers in animals)

II. Parathyroids.
1. Inactivity due to lack of Vitamin D.
2. Inactivity due to disease.
3. Overactivity due to disease.

III. Abnormal Absorption.

IV. Abnormal Excretion.

V. Disease of the Bone.

gosterol. Vitamin D has two functions: it increases the absorption of calcium through the intestines, and it activates the parathyroid glands.

In the early stages of osteitis deformans we find osteoporosis, high blood calcium, and increased excretion of calcium. From these findings we may postulate an over-activity of the parathyroid glands. Later in the disease, when the formation of osteoid tissue and the erratic deposition of calcium in the bones occur, the blood calcium is found to be low and excretion is diminished. At first glance it would seem that under-activity had followed upon the preceding over-activity, but, by the token that calcium is deposited abnormally in large amounts in the bones, over-activity may be said to persist with *deranged* activity as an added factor.

In a study of eight cases, a low normal blood calcium (9 to 9.5 mg./100 c.c.) was found in four of the cases in which the duration of the disease was known to be five years or more, whereas, in the other four cases, which were of shorter duration, the blood calcium was found to be above normal (11 to 12.3 mg./100 c.c. of blood).

Since bone destruction was going on in all of these cases irrespective of their duration or other processes, we wanted to see in what way, if any, a high calcium intake would affect the calcium situation. Calcium lactate, or milk, and Vitamin D were given, also Vitamins A, B, and C. On this régime headache, backache, and stiffness in the legs were alleviated. There was marked improvement in the ability to walk and in three cases the patients abandoned their canes, without which they had been unable to get about. One woman had not been able to get up from a chair or to walk without assistance. She had had pains in her thighs and back. Improvement in her condition, which was marked after three weeks' treatment, has been continued for over two and one-half years. She is able to do her housework, walks without a cane, and has been free of pain up to the present day. In this case, roentgenologically, there is no evidence of advance in the disease. In one other case, in spite of improvement in symptoms, there is marked progress in the bony changes, especially in the skull, which has increased in size during two years of observation and treatment.

Before coming to the New York Hospital, a number of patients had received calcium treatment without improvement. Administration is unavailing unless due regard is given to the conditions under which calcium is absorbed, which does not take place unless the digestive tract is empty.

Our régime is as follows:

Viosterol, drops X, three times a day,

Tomato juice, 6 ounces, three times a day,

Calcium lactate, gr. XL, twice a day.

This is given one hour before breakfast and four hours after supper, or, if the second dose keeps the patient up too late at night, it may be given four hours after luncheon and one hour before supper. This régime is followed for two weeks, then three glasses of milk a day are substituted for the calcium lactate. A long continuance of the administration of calcium lactate often results in frequency of urination, hence alternating milk with the calcium lactate is found advisable. Every fourth week viosterol is discontinued for five days.

Treatment with parathyroid extract was next tried. The blood calcium was raised, as it was with the high calcium and vitamin régime, but there was no improvement in symptoms; in fact, the patients felt generally worse than with no treatment at all. Parathyroid extract increases the blood calcium by taking it from the trabeculæ, which apparently, in this disease, are already giving it up excessively.

We are handicapped by the lack of instruments of precision for measuring the calcium situation *in vivo,* but in the present

state of our knowledge, from what observations we are able to make, over-activity and dysfunction on the part of the parathyroid glands seem to be of etiologic significance in osteitis deformans.

In view of the similarity of all these cases of osteitis deformans we think it would be a waste of time and money to put illustrations of all the cases in this article and are, therefore, showing photographs of the entire skeleton of one of the patients who exhibited characteristic changes.

CASE REPORTS

Case 1. G. W. N., aged 47 years, was admitted to the hospital on Feb. 7, 1927, the chief complaint being deformity of the bones and soft parts, with pain. The illness began three years before the present examination, when the patient noted a small lump on the anterior aspect of his left tibia. This was hard and bony in character and gradually increased in size, but was not painful except when struck. At a slightly later period the left knee began to swell and was painful, becoming stiff. Two years before admission to the hospital the patient, while throwing a baseball, sustained a fracture of the right humerus. Shortly after this had healed he fractured his left clavicle in alighting from a trolley car. About one and one-half years before examination the upper end of the left humerus began to swell and the shoulder to stiffen. The patient was able to abduct the arm only to a right-angle. In December, 1926, the shoulder became very painful and the patient complained of great heat in it, while the swelling increased rapidly.

During the entire course of his illness the patient had noted an increasing bowing of the legs and an increase in the size of his head, stating that it felt lumpy. There was gradual increase of pain in the back and legs. About three weeks previous to admission, a tumor mass appeared on the anterior aspect of the right humerus, at the site of the previous fracture. At almost the same time the patient noted a cystic swelling in the right temporal region and about a week later two similar, though smaller, swellings appeared on the left forehead. He also complained of difficulty in walking and inability to adduct the left femur, due to a hard bony mass in the region of the lesser trochanter.

The past history comprised the usual childhood diseases but no other diseases or infections. The man had always been athletic in his habits. His family history was negative, except that the cause of his mother's death, at 86 years of age, was unknown. There was no history in the family of disease similar to that presented by the patient.

Physical Examination.—The patient was an under-nourished white male, who appeared chronically ill. Inspection showed a typical enlargement of the cranium and a face triangular in appearance. The anterior bending of the spine and the anterior bending and bowing of the femurs and left tibia gave the typical posture of Paget's disease. Over the right temporal bone was a cystic mass about 4 cm. in diameter. In the left frontal region were two firm masses about 1.5 cm. in diameter. The left clavicle was prominent and thickened, with a firm mass about the size of a walnut present near the outer end. The heart and lungs were negative. The liver showed some enlargement. The extremities showed bowing of the tibias, especially the left, bowing and thickening of both femurs, and a hard bony mass in the region of the lesser trochanter. The knee jerks were active. The left shoulder showed definite fusiform hard swelling of the upper third of the arm, which impaired the shoulder movement. The skin appeared fairly normal and its temperature was not elevated. Over the anterior aspect of the right humerus, about its middle third,

was a hard swelling nearly the size of a plum. It was fixed, and seemed attached to the bone. In the lower portion of the left arm was a similar hard swelling, but smaller. The left knee showed a generalized swelling, most marked on the inner side. The ankles and feet seemed normal.

X-ray Examination.—Marked cortical thickening, irregularly striated, periosteal bone production and cystic formations were clearly seen in the left tibia, both femurs, the bones of the pelvis, and the spine. In addition, there was a marked increase in the size of the lesser trochanter of the left femur, giving the appearance of a large osteoid tumor. Examination of the skull showed marked deformity and thickening of the cranial bone, with irregular calcific deposits between the outer and inner tables. The right humerus showed the same changes as noted in the other long bones, and a tumor in the soft parts could be clearly seen. The left clavicle also showed degenerative changes and evidence of the old fracture. The upper end of the left humerus was almost completely destroyed, but showed some irregular calcific material in the region of the extensive tumor which invaded the soft parts.

X-ray diagnosis was typical Paget's disease, with degeneration and formation of an osteogenic sarcoma.

Laboratory Findings.—The blood showed: red cells, 4,592,000; hemoglobin, 47 per cent; white cells, 9,800; polymorphonuclears, 76 per cent; lymphocytes, 21 per cent; Wassermann, negative.

Blood calcium: at first, 10 mg. per 100 c.c.; later, 12 mg. per 100 cubic centimeters.

Urine analysis: negative; no Bence-Jones bodies; urine calcium, 0.211 grams in 24-hour output.

During the patient's stay in the hospital his temperature varied between normal and 99° for the first seventeen days. On the eighteenth and nineteenth days it was 102°. It then returned to the previous range of from normal to 99° until a few days before death, when it ranged from 100° to 103.5°. A consultation was held and it was decided that the numerous tumor masses were due to sarcomatous degeneration, for which high voltage therapy was advised. The patient was given eight therapeutic exposures to the left shoulder, anterior and posterior; to the lower dorsal and lumbar spine; to the left groin and femur, and the right humerus both anterior and posterior. John Remer, M.D., gave these treatments, using the following factors: 200,000 volts; 4 ma.; 50 cm. distance, with 0.5 mm. copper and 1 mm. aluminum filter. The total dose administered was 70 per cent depth dose to the different areas. Though the X-ray therapy resulted in no decrease in the size of the sarcomatous masses or X-ray evidence of changes, there was very marked relief from the patient's symptoms of pain and discomfort. He died on the forty-fifth day in the hospital. No autopsy was obtained.

Case 2. Mr. McD., aged 59 years, was admitted to the hospital on March 31, 1926, complaining of headache, dizzy spells, and convulsive seizures. He gave a history of two injuries in childhood, with no sequelæ. For the fifteen years previous to examination he had had attacks similar to the ones for which he was admitted, but lately these had grown worse. Two injuries had occurred since the onset of his present illness. These attacks were always preceded by an aura, accompanied by spastic movements of the extremities and loss of consciousness. At times the attacks were limited to a short convulsion; at others, they proceeded to loss of consciousness. They varied a good deal, but always started on the right side. Sometimes the man ground his teeth and bit his tongue. The patient had had a large amount of medication, with no relief, and had lost considerable weight. In 1925 he had had an attack of marked epigastric pain.

The present condition showed nothing unusual except for the subjective symptoms. The family and past histories were irrelevant. The physical examination was entirely negative except for slightly hyperactive knee jerks and slight hyperactivity of some of the other tendon reflexes. The positive findings were that the history suggests a *petit mal* (Jacksonian epilepsy); slight sluggishness of the right pupil; slight deviation of the tongue to the right; large square head; slight impairment of hearing on the right side, and marked loss of weight.

X-ray Examination.—The gastro-intestinal tract showed spasm of the pylorus, but was otherwise negative. Examination of the gall bladder was negative. The liver shadow seemed to be slightly enlarged. There was definite condensation of the body of the fourth lumbar vertebra, indicating an increased density of the bone due to calcium deposit, which suggested the sclerosing type of carcinoma metastasis. The bones of the skull showed marked thickening and mottling, with distinct rounded areas of increased density in both parietal areas, as well as rarefied areas. There was a slightly similar process in the right ischium and greater trochanter of the right femur. These findings were interpreted as osteitis deformans (Paget's disease).

The urinary examination was negative.

Blood Examination.—Red cells 4,256,000; hemoglobin, 100 per cent; white cells, 6,400; polymorphonuclears, 74 per cent; lymphocytes, 24 per cent; Wassermann, negative.

During the patient's stay in the hospital he was afebrile; the pulse and respiration were normal.

Summary.—This patient was evidently suffering from either epileptiform attacks or pachymeningitis, as there is nothing in his history that would suggest Paget's disease, although the X-ray findings are unquestionably those of Paget's. This probably means that the patient has a complication of these two diseases.

Fig. 1. The characteristic appearance of Paget's disease in the advanced stages—bent shoulders, curved back, sunken chest, long arms, bowed legs.

Case 3. M. W., aged 42 years, married, was admitted to the hospital on July 24, 1924, with the chief complaints of weakness and insomnia. The past history was negative except for attacks of quinsy.

Present Illness.—For some three months the patient had been feeling weak and tired all the time although she had gained about five pounds. Insomnia, with headache in the posterior portion of the head, and pains in both legs had been constant features. In

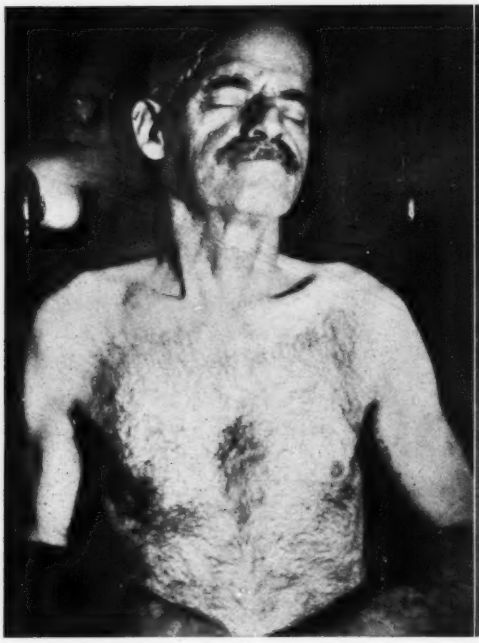


Fig. 2. There is typical enlargement of the cranium; the head is a triangle with the base above.

Fig. 3. The softened bones of the leg become bent; the femur bends outward, the tibia forward.

addition, there had been pains in the eyes, and difficulty in going upstairs, with dyspnea and marked palpitation on exertion. The family and personal histories were negative.

Physical Examination.—The patient was an obese woman who appeared chronically ill. She exhibited edema under both lids, ptosis of the right lid, and irregular pupils. The mouth showed fair teeth and diseased tonsils. The lungs were negative, the heart rapid and of poor muscular tone. The blood pressure ranged between a systolic of 110 and 130. The abdomen was negative. The extremities showed slight edema of the ankles. There seemed to be swelling over the left greater trochanter; very slight limitation of flexion; marked limitation of internal rotation, and marked tenderness on pressure over trochanters. The patient's posture in the erect position was bad.

Laboratory Tests. — Urine, negative. Blood count, essentially normal. Wassermann, negative.

Basal metabolism was —13. Blood calcium, normal.

The patient was under constant observation until Oct. 20, 1927. On October 15 she reported very marked pain in the toes. On examination, they were seen to be shiny and of a bluish-red color, which strongly suggested, both from her description and the physical findings, a beginning thrombo-angiitis obliterans.

X-ray Examination. — The radiograms showed a thickening of the cortex of the upper third of the left femur and some anterior bowing. There was a coarse striation in the region of the greater trochanter and neck, with an occasional small area of decreased density. The pubic bones, right ischium, and the wing of the right ilium showed the same changes. The lumbar spine was negative except for a hypertrophic

osteo-arthritis. The skull showed irregular areas of increased density between the inner and outer tables, which were more marked in the posterior half. There was considerable thickening, particularly in the occipital region. The other bones were negative. The diagnosis was osteitis deformans (Paget's disease).

Summary.—The attending physician's note was as follows: "The X-ray examination showed unmistakably the condition in the left femur, bones of the pelvis, and skull so characteristic of Paget's disease. The patient showed none of the clinical signs of Paget's disease and the age is rather young. It is interesting to note that this patient bears a close resemblance to the myxedema syndrome, in view of the theory that osteitis deformans may result from a calcium imbalance caused by disease of the parathyroid glands."

Case 4. C. M., female, 53 years of age, was admitted to the hospital in December, 1923, complaining of swelling of the head, and deafness. For eight or nine years she had noted that her head was increasing in size on the right side. For three or four years she had had pain in her right ear, with increasing deafness. For the last few months before admission to the hospital she had noticed a headache in the frontal region when she coughed. She had been gradually losing weight for the five or six years preceding the examination.

The family history was entirely negative and no similar disease had ever been noted in the family. The past history was as above except that, in addition, the woman had been tiring easily for the previous few years and had had slight dyspnea and palpitation.

Physical Examination.—The patient presented a striking osteitis deformans appearance: had a vacant dull appearance, was short of stature, and appeared stooped. The head was triangular in shape, with the apex downward. There was an unusually round-

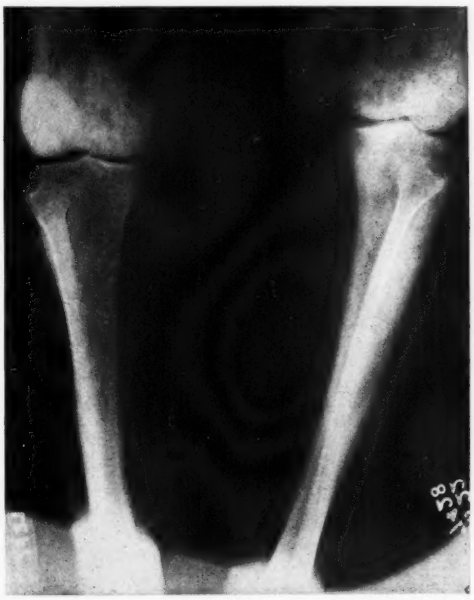


Fig. 4. The architecture of the bone is disorganized by osteitis deformans.

ed prominence on the right side in the temporal parietal region. Palpation of the head revealed thickening at the base of the skull, and increase in bone in both temperoparietal regions, with a definite rounded prominence on the right side. The circumference of the head was 66 centimeters.

The spine showed no definite kyphosis but a definite rounding of the shoulders. The left clavicle was unusually thickened and irregular. The ribs showed no abnormalities. The pelvis was settled and unusually funnel-shaped. There was slight thickening about both elbows in the upper extremities. The femurs did not appear bowed. There was general thickening about both knees and the anterior surface of the left tibia. The tibia was thickened in its upper third. The rest of the physical examination was negative.

The reflexes were all present. The blood count was normal and other laboratory tests showed no changes.

X-ray Examination.—Definite involvement of the skull, both femurs, and the

Fig. 5. The vault of the skull presents a serrated appearance, and the diploë disappears, the distinction between the outer and inner tables being lost.

bones of the pelvis was demonstrated by X-ray examination. There also seemed to be some changes in the ribs and the left clavicle, which showed typical bizarre arrangement in the bone trabeculæ, thinning out of the bone, and bizarre calcific deposits so typical of osteitis deformans.

The patient, who was afebrile, left the hospital after staying seven days and no trace of her has since been possible.

Case 5. G. C., male, 43 years of age, was admitted to the hospital in August, 1916, for a broken leg. About ten years previous to the present examination, the patient had begun to have pain in the left leg, extending the entire length of the shaft. The pain had been more or less constant up to the time of examination and it was getting gradually worse. Six years before admission to the hospital the patient fell and fractured the left femur just above the knee. The fracture healed, and there had been perfect function of the leg for two years. Then pains began in the right leg and the patient was forced to stop work on account of pain, weakness, and stiffness in both legs and knee joints. He had been confined to bed almost constantly for two years before examination. In August, 1916, while turning in bed, the patient fractured the left femur about five or six inches above the site of the old fracture.

The history was difficult to obtain as the patient could not speak English. The past history was negative except as described above. The family history was negative.

The fracture was treated and reduced, a circular plaster spica being applied.

X-ray Examination.—The patient exhibited a fractured left femur which extended through the shaft. The changes in the bone were quite typical of osteitis deformans.

Laboratory tests were negative.

The patient was discharged early in September, the leg healing. In April, 1917, report was that the patient had been in a city hospital for seven months with disease of the bone which was becoming progressively worse. There was no further follow-up.

The interesting thing in this case seems to be, if the patient's history can be depended upon, that his osteitis deformans started ten years previous to examination, which would make him 33 years of age. This is rather young for osteitis deformans but we feel the changes are so characteristic and the history so suggestive that he must come under this class.

Case 6. Mrs. G. H., aged 47 years, was admitted on June 30, 1925, to the Bloomingdale Hospital. The patient's family and personal histories were negative except for the mental condition for which she was admitted to the hospital.

The present illness dates from 1921, when a spur was noted on the patient's spine. She was examined by an orthopedic surgeon, who stated that the condition was either tuberculous or due to carcinoma. She was fitted with a spinal jacket, which she wore for a year, at which time she was pronounced well. Six months later it was

Fig. 6 *(upper left)*. Enlargement of the skull is one of the first signs to appear in osteitis deformans. Fig. 7 *(upper right)*. Fig. 8 *(lower left)*. Fig. 9 *(lower right)*. The cortex loses its dense character and sharp outline; the marrow cavity is encroached upon.

noted that she was becoming round-shouldered, and she complained of pain but there was no local irritation. The patient had several Wassermann tests made, but all were negative. She attempted to commit suicide by cutting her wrists and exhibited symp-

toms of manic depressive. She lost about eight pounds in weight.

Physical Examination.—The patient was a poorly nourished woman; weight, about 100 pounds; face, somewhat puffy; color, poor; heart and lungs, negative except for a slight cardiac enlargement to the left, with soft systolic murmur; blood pressure, 106/50. There was slight edema of the ankles and the back showed angular deformity in the mid and lower thoracic vertebræ. The face was rather expressionless. The reflexes were slightly exaggerated. The rest of the examination was negative except for slight deformity and slight bending and thickening of the bones of the arms and thighs.

Blood Count.—Red blood cells, 4,500,000; hemoglobin, 60 per cent; white cells, 9,950; polymorphonuclears, 70 per cent. The blood chemistry showed nothing unusual and practically the normal amount of blood calcium.

X-ray Examination.—The spine showed marked changes in the region of the first, second, and third lumbar vertebræ, and obliteration of the normal outlines of the bodies, with displacement of the arterial surface, resulting in kyphotic deformity. These vertebræ showed very marked osteoporosis, giving a distinctly moth-eaten appearance. This condition extended to the sacrum, to both ilia, and the pubic bones. The upper ends of the femurs were likewise involved. The shafts of the femur and tibia were apparently normal. The right humerus showed some osteoporosis, which resulted in a moth-eaten appearance, extending along the middle of the shaft. The left humerus, on the contrary, showed marked defect, including throwing up into ridges of the shaft of the bone, with smaller areas of rarefaction in the lower ends of both radius and ulna. The shaft of the radius was fairly normal in appearance, but the shaft of the ulna had the same moth-eaten appearance as noted in other bones. The left radius and ulna were only slightly involved. The ribs also showed a considerable degree of rarefaction, giving them an irregular moth-eaten appearance.

X-ray examination of the chest showed the heart to be triangular in appearance, and enlarged (especially to the left) with a widening of the arch of the aorta. The apices were poorly illuminated. There was no irregularity of either diaphragm. There was considerable mottling at the roots of both lungs, with much increase in the peribronchial tissue. X-ray examination of the skull showed a slight degree of irregular rarefaction, giving a moth-eaten appearance such as is seen in osteitis. These findings were diagnosed as due to osteitis deformans.

The patient was discharged on Nov. 16, 1926, much improved, and no further history was obtained.

Summary.—The age at which the onset of the disease occurred, namely 44 years, together with the characteristic X-ray findings, seems to place this case in the classification of osteitis deformans (Paget's disease). The mental symptoms probably have no bearing on the bone disease, though this patient, like the last two cases, showed some abnormal brain condition. Three cases, however, do not seem to be sufficient to warrant drawing any definite conclusions.

Case 7. Mr. T., aged 70 years, is included in the series simply for the reason that his right femur and right ilium, ischium, and pubis exhibit the changes which are capable of interpretation as either osteitis deformans or osteitis fibrosa.

The history has no bearing whatever on the case. The patient had always been healthy and the only point which might be regarded as of any significance is that for a number of years he had had what he described as "twinges of rheumatism," and his knee joints, the articulations of the lumbar

vertebræ, and the left hip showed evidences of an hypertrophic osteo-arthritis.

On Dec. 5, 1926, at the age of 69 years, the patient was struck by an automobile, sustaining a fracture of the ninth rib on the right side and a fracture of the neck of the right femur. He was given the usual treatment for the fracture of the femur, remaining in bed for some twelve weeks. A radiograph, taken ten months later, still showed the marked osteoporotic, lacy appearance of the bone, with the mottling by areas of decreased density, suggesting beginning cystic formation. The skull showed no variations from the normal.

Summary.—Are we to class this patient as a case of osteitis deformans, localized to the ilium, femur, right ischium, and pubis, or are the changes due to marked atrophy of disuse, accentuated by the patient's age? The evidence in favor of atrophy of disuse seems rather weak, as the radiograph made ten months after discharge from the hospital, while the patient was walking some three miles a day in the course of his occupation, showed the same changes to be present. Frankly, this is unquestionably a case which, in the light of our present knowledge, we cannot definitely classify. However, the atrophy of disuse, it seems, can be ruled out on the unilateral distribution of the changes, which would place the condition either in the group of osteitis deformans or in that of osteitis fibrosa cystica.

Case 8. Mrs. H., white, 57 years of age, consulted her physician for pain in her left leg, with increased anterior bowing of the lower leg. She had noticed this pain for several years but was not definitely sure for how long; the bowing had been present for three years. She paid very little attention to this until she struck her leg against a chair and heard something snap. She then found it difficult, in fact almost impossible, to walk on this leg. The radiographs made at that time showed definite disturbance in

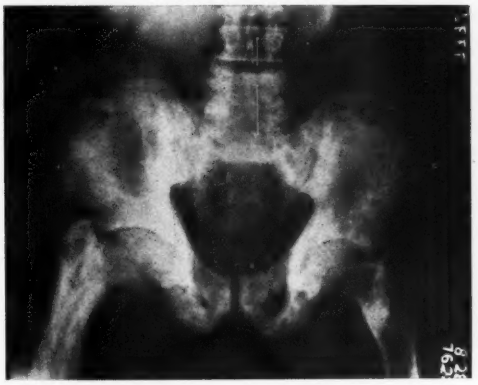


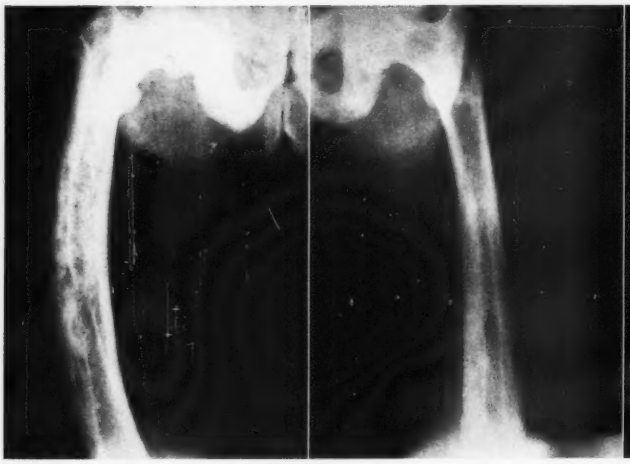
Fig. 10. Broadening of the pelvis is characteristically seen under X-ray examination.

the bone trabeculæ, with cystic formation and bizarre calcific deposits with marked anterior bowing of the left tibia. There was also beginning involvement of the lower end of the left femur. The patient denied any knowledge of change in this bone previous to three years before the present examination. She was treated by the application of plaster, whereupon the fracture healed. She was then referred to an orthopedic surgeon, but, upon walking into his office, she turned her ankle and sustained two fractures of the tibia.

In view of the age of this patient and the characteristic changes in the tibia, even though the other bones were negative for any changes, one feels this is probably a case of osteitis deformans.

Case 9. Mrs. E. B., aged 50 years, entered the hospital May 2, 1927, the chief complaints being loss of weight, and weakness.

Present Illness.—For eighteen months preceding examination, the patient had noted a feeling of weakness and of being generally below par. Her friends had noticed an occasional swaying as she walked. She, herself, had noticed a tendency to deviate to one side, and a desire to put out her hand to steady herself. Occasionally she felt light-headed, but had only transitory pains



Figs. 11 and 12. A well-defined thickening is associated with the softening of the bones, which, due to the weight, causes the femurs to bend outward.

Fig. 13. The bones of the lower limbs are usually first affected, the tibia bending forward.

in the head and no other pains. Fifteen months previous to her admission she had had a clinical examination in another institution, but at that time no lesions were found. No X-ray examination was made then. The patient had noticed an occasional numbness in her hands and weakness in her legs.

The past history was negative except for tonsillitis in childhood and swelling of her joints two years before examination.

The family history was negative except that the mother died at the age of 76 years from arteriosclerosis.

Physical Examination.—The patient was a well developed and well nourished adult female, who did not appear acutely or chronically ill. She walked with an unsteady gait and showed a tendency to fall toward the right side. The rest of the physical examination was negative except for superficial varicose veins in both legs and definite accentuated tendon reflexes in the biceps, triceps, and knee jerks.

X-ray Examination.—The skull showed typical, irregular, dense, calcific deposits, with the slight thickening of the outer table which is considered characteristic of Paget's disease. The second lumbar vertebra, the ilium, pubes, and ischium on both sides showed some deformity, being of irregular striated appearance and suggestive of cystic formation as the result of osteitis deformans. The gastro-intestinal tract was essentially negative.

Laboratory Examination.—Red blood cells, 4,544,000; hemoglobin, 82 per cent; white blood cells, 7,200; polymorphonuclears, 66 per cent; lymphocytes, 33 per cent. The Wassermann test was negative. Blood sugar, 0.11 per cent; blood calcium estimation not made. Urine: no Bence-Jones bodies; negative for sugar and albumin.

The patient was in the hospital for some ten days and showed no other points of interest. The history and clinical findings were inconclusive, but, from the X-ray examination, the diagnosis was Paget's disease.

Case 10. The patient, T. S., aged 63 years, was an apartment house janitor who came to the Compensation Department because he had fallen and injured his knee while tending the furnace. Physical examination showed thickening of the tibia and slight anterior bowing, but X-ray examina-

tion showed no evidence of fracture. The changes were interpreted from the X-ray findings as due to Paget's disease.

Unfortunately this patient did not return for X-ray examination of the skull and other bones and no past history was obtained, so that one includes this case as illustrative of Paget's disease solely on the X-ray diagnosis.

Case 11. Mr. K., first observed in 1914, was at the time of examination 58 years of age.

At the initial X-ray examination a diagnosis was made of small gastric ulcer on the posterior wall, and possibly two small urinary calculi. In 1922, when the patient was again radiographed, the ulcer was not seen, and there was a delay in the third portion of the duodenum. A retrocecal chronic appendix was also diagnosed, and gastric retention was noted, interpreted as due to thickening of the pylorus from the old ulcer. In 1927, the patient was seen by Dr. Williams, who elicited the history that in boyhood the patient had had an attack of appendicitis but no operation had been done.

The physical examination was negative. The patient suffered moderately from constipation and had occasional gaseous discomfort, which was relieved by powders. For the three years preceding examination he had had an irritating pain in the tongue, which showed a small induration. He smoked a good deal, was rather nervous, and had bad teeth, but they were being treated. He had no symptoms referable to the head, and had never had any bone or rheumatic pains. His history seemed to be entirely gastro-intestinal.

X-ray Examination.—Radiographic examination, made on Jan. 20, 1927, showed a definite sclerosing process in the body of the second lumbar vertebra. A sclerosing process, though not so pronounced, with definite mottling and disturbance in the bone trabeculæ, was noted in the left ilium, and, to a lesser degree, in the right. The patient's skull showed the frontal and both parietal bones to be mottled by definite areas of increased density, which were irregular in outline. These areas were not characteristic of bony metastasis, and, when considered in conjunction with the findings in the second lumbar vertebra, the ilia, and the sacrum, one's impression would seem to be in favor of a diagnosis of early Paget's disease.

Summary.—This is another case in which no history, either family or personal, can be elicited to confirm the X-ray diagnosis of Paget's disease, though the changes noted on X-ray examination are so characteristic that there seems to be no doubt of the correctness of the diagnosis.

Case 12. Mr. H. is a man past middle life whose X-ray examination showed the typical changes of osteitis deformans. Unfortunately he is a private patient who was referred to the office, so that no history was obtained and none of the laboratory tests was done to our knowledge. We have since lost trace of the patient. We are reporting him in the series simply because of the characteristic bone changes.

Case 13. W. R., white male, 37 years of age, was brought to the hospital on April 7, 1930, complaining of pain and stiffness and bowing of the left thigh which had begun 18 months previous to the examination. The family and past histories were negative except for the usual childhood diseases. The patient, who had played professional football for the preceding six years, and who was quite active in other sports, gave a history of many injuries to his head and neck. He had received a fracture of the jaw in 1927. He gave no history of headaches and was subject to very few colds. He had noticed slight deafness in the left ear for a year but no dizziness. Upon close questioning, the patient recalled that his symptoms probably started three years earlier, after an injury to his neck in a wrestling match.

The first symptom was a dull aching pain in the left thigh, with generalized tenderness. About one month later the patient noted a slight bowing of the thigh which progressed slowly for two years. About one year before the present examination, for eight or nine days, there was definite increase in deformity and severe pain, which had now ceased. He had received no treatment.

Physical Examination.—The patient was a man who appeared well—stocky, with a large head. There was slight lateral curvature of the left thigh and a slight waddling gait. The shoulders were slightly stooped and the head was held stiffly. The skull was negative, except for being large. The neck was somewhat stiff on backward motion. The thorax was negative, the lungs clear, and the heart signs normal. The blood pressure was 118/60. The abdomen was negative and there was no tenderness or stiffness in the back. There was some rotation in all joints, most marked in the left hip and right shoulder. The patient exhibited marked crepitation in the large joints and the small joints of the fingers. The left thigh showed considerable forward and lateral bending, which was also present in the right, but less marked.

The patient was given a most exhaustive blood study. The calcium was about normal in all these tests and the other blood findings were also fairly normal. The basal metabolism was +34.

The patient, who remained in the hospital for three months, was afebrile throughout his stay. Studies on his blood chemistry were done during the course of eleven five-day periods, and during each of these periods he was on definite food and some drug intake. The food, urine, stool, and blood analyses at each period were tabulated. These analyses are not yet all completed but the calcium is slightly elevated, the phosphorus normal, and the cholesterol decidedly low, being at one time 95 milligrams. His icterus index had always been elevated into the zone of latent jaundice, but none of these findings can as yet be correlated; neither can it be said that there was any clinical improvement. However, the patient was put on a high calcium diet and given 50 drops of viosterol per day.

X-ray Examination.—The bones of the skull and all bones except the radius and ulna in both arms and the bones of the spine and pelvis, showed the characteristic changes of osteitis deformans.

This case seems to be of particular interest in that the onset of the disease was at the age of 34 or, at the most, 34½ years, which is rather young for osteitis deformans.

Case 14. The patient, M. C., was a white female, 54 years of age. At the age of 50, she had complained of pain in her left hip, which persisted and became worse. It was diagnosed as arthritis. No results were obtained from autogenous vaccine or by diathermy. One year previous to the present examination she was said to have had tuberculosis of the hip, but the present X-ray examination revealed typical changes of osteitis deformans in the bones of the pelvis and left femur. There were also slight changes in the bones of the skull.

Her blood calcium was 11.2. Her Wassermann test was negative, as were the other tests.

On Feb. 28, 1930, the patient was put on viosterol, drops 25, three times daily; calcium lactate, gr. 60, twice daily; tomato juice, 6 ounces. This therapy has been continued with the exception, as in other cases in which calcium has irritated the kidneys and bladder, of a period during which milk is alternated with the calcium. The patient has shown definite, though not very marked, improvement in her clinical symptoms. Later X-ray examinations show no change in the bones.

Case 15. S. D. M., white male, 56 years of age, is not a very intelligent type. He

gave a history of pain of three weeks' duration in his right shoulder, but showed no noticeable change in the size of his head. No other history could be obtained on close questioning. From the appearance of the X-ray films of the right shoulder, a well-established osteitis deformans was found to be present, which certainly had existed for longer than three weeks. Changes also were present in the skull and left humerus, and extensive involvement in the dorsal and lumbar spine, as well as in the bones of the pelvis and the heads and trochanters of the femurs. Slightly less advanced changes showed in the tibias. Therefore, with these X-ray findings, it was apparent that the patient had had this disease for some time.

Blood calcium, 9.8; phosphorus, 3.5; cholesterol, 1.65.

June 9, 1930—He was given viosterol, milk, and tomato juice.

Aug. 1.—The patient returned, feeling much better, although he still had some pain in the arm. Calcium lactate with viosterol was prescribed twice a day instead of three times.

Aug. 22.—The patient had considerable pain in the right shoulder and arm. The pain diminished but stiffness and pain in the back of the neck were present and the patient could not sleep. The régime was continued, with heating and massage to the neck, and luminal, one-half grain, was prescribed for pain.

Sept. 16.—The patient still complained of much pain. The régime was continued with the addition of sodium acid phosphate.

Oct. 1.—Considerable pain and stiffness were complained of. Viosterol, 30 drops, was prescribed instead of calcium lactate.

Oct. 8.—Sodium phosphate was discontinued; otherwise the same régime was adhered to.

Oct. 15.—The patient felt fairly well; the pain was considerably lessened, though usually it became much worse in warm weather. The régime was continued, except the man was ordered to take clinradol instead of viosterol.

Oct. 21.—The patient was fairly well and felt much better, although he slept poorly. Clinradol was continued.

Oct. 27.—The patient stopped smoking for ten days and the régime was continued. Complaint was made of severe pain and burning in the left shoulder. Blood sugar test was made on Oct. 29, showing 112 mg. of sugar.

Nov. 3.—One glass of tomato juice and four glasses of milk per day were ordered. The pain in the left shoulder was still severe.

Nov. 10.—Tomato juice was discontinued and acid phosphate substituted.

Nov. 17.—Tomato juice, calcium lactate, and clinradol were ordered. As sodium acid phosphate made the patient ill, it was discontinued. Complaint was still made of pain in the arm.

He is being continued on treatment.

Case 16. H. B., a white woman, 58 years of age, was admitted to the hospital in December, 1927. She complained of difficulty in walking, had assumed a waddling gait for one and one-half years, and had experienced a feeling of heaviness in the lower limbs for the year preceding examination, with shortness of breath and general weakness.

The family history was negative as was the past history, except for the usual childhood diseases. The patient said that in 1907 she had had an exophthalmic goiter which had been cured by medication and X-ray therapy.

Present Illness.—The patient had been in good health until three years before admission, when she first noticed a slight bowing of the legs, although this did not trouble her in any way. As a child she had not been bowlegged. The bowing gradually increased. Two and one-half years before the present

examination, she noticed stiffness in her legs which usually was present after considerable walking. There was no pain in her legs. This condition continued until about one and one-half years previous to examination, when she had difficulty in walking. She noticed about this same period that she had to get larger sized hats. Otherwise no deformities or pathologic fractures were present and the patient seemed in fairly good health.

X-ray Examination.—Several examinations made in 1927 showed very typical changes of osteitis deformans involving the skull, the dorsal and lumbar spine, entire right tibia and head of the left, the pelvis, both femurs, and the heads of the humerus on both sides.

Calcium lactate and acid sodium phosphate were prescribed and the patient's blood calcium is being followed carefully. She has steadily improved on this treatment, has been able to return to work, and is feeling fairly well. The deformities remain the same.

Case 17. C. S., white male, 73 years of age, was admitted to the hospital first in 1908 for urinary retention, rectal abscess, and ulceration of the rectum. The abscess was incised. He was re-admitted on Aug. 23, 1930, after being struck by a vehicle, when he sustained a laceration of the forehead and contusion of right eye, and was rendered unconscious. After recovery from unconsciousness the man was found to be moderately deaf. He had an unusually large head, the sternum was prominent, and the arteries hard and thickened. Knee jerks were absent. In the phalangeal joints of the hands there was definite enlargement, and the other bones were slightly thickened, with some bowing.

X-ray Examination.—The skull, spine, humeri, shoulders, ulnas, tibias, fibulas, and pelvis exhibited the characteristic changes of advanced osteitis deformans. The femoral and iliac arteries showed extensive calcification; also extensive hypertrophic osteo-arthritis was present.

This patient was treated with calcium lactate and viosterol for a short time and then trace of him was lost.

Case 18. V. K., a white man of 39 years, was admitted to the hospital on Dec. 13, 1917, complaining of recurrent fracture of the lower right leg. He said that his shins had always bulged as do the shins of his father and brothers. The bowing had increased markedly in the few years preceding admission to the hospital. About two and one-half or three months earlier the patient had fractured the lower right leg by falling. He was treated and put in plaster, which was removed just a few days before admission. The patient was walking downstairs when he stumbled and his right leg crumpled up under him.

The man's past history is negative except for previous fractures. He had had five blood tests, which were always negative, for specific trouble.

X-ray Examination.—Radiograms showed a pathologic fracture due to a very typical change of osteitis deformans.

No further examination was made of this patient and he was treated for the condition. One feels that, though no skull films were made, the changes are in all probability due to osteitis deformans. This is another case in which osteitis fibrosa cystica, particularly in view of the patient's age, cannot be eliminated.

Case 19. Mrs. R., white female, 61 years of age. About six years before the present examination, she noted pain and stiffness of her right knee. She recollected back over fifteen years and said that at that time she had had some trouble with her back. She did not know what this was except that it was painful and caused limitation of motion. Her other history and physical findings were negative except for an increase in

pain and disability, with increase in the bowing of her legs. She had also noted that her head was becoming larger. The blood calcium was 9.6.

Treatment was first started on Dec. 17, 1927, being the same as in the other cases, and was continued up to Oct. 27, 1930.

Throughout her illness this patient complained of severe headaches. At times the calcium and viosterol medications relieved them, but at other times nothing was effective except nitroglycerin. This was given in an attempt to reduce her blood pressure on the theory that her headaches might be caused by a dilated blood vessel at the base of the skull where the blood vessels pass into the cranial cavity through the opening which is contracted by encroachment in the foramina by an increase in bony deposits. This medication has been quite effectual.

The patient's condition has remained stationary, except that when she is put on a high calcium diet she feels well and has no pains except the headaches and is able to do a certain amount of her housework. However, as soon as she is on a low calcium diet she becomes much worse.

Radiographs made during the period from 1927 almost to date (November, 1930) have shown practically no change, being typical at all examinations of osteitis deformans.

Case 20. I. L., white, housewife, aged 62 years. The patient complained of pain in leg, and bowing, which had been present for several years. The onset of disease was apparent eight years preceding this examination, with pain in her leg. Three or four years before examination, she had noted a beginning enlargement of her head and a little later beginning bowing of her tibias. For two years there had been pain in her leg and occasionally pain in the arms but no headaches. There had been diminished hearing for two or three years before admission to the hospital, with general weakness and considerable difficulty in walking. X-ray findings of the skull, pelvis, spine, and long bones were very typical of osteitis deformans.

Oct. 7, 1930.—The patient was given viosterol, drops 30; tomato juice and milk, three glasses of each every day.

Oct. 15.—The patient felt much better, the weakness was lessened, the pains diminished, and she said she felt more "limber." Medication was continued.

Oct. 28.—Calcium lactate was alternated with the milk every two weeks. The woman experienced pain in her back and when walking, but otherwise was considerably better and able to do her housework.

Nov. 17.—There were slight pains in the arms and legs; however, the patient was able to walk and to do her housework. The régime was continued except that clinradol was substituted for viosterol.

The patient has continued in fair health up to the date of this report.

Case 21. J. S., a white man, 67 years of age, was admitted to the hospital on Aug. 3, 1930, complaining of diabetes and of urinary symptoms which had been present for three months. For two years preceding admission he had noted enlargement in the size of his head and weakness of the legs. Three months before examination, the patient had noted frequency of urination, increase in appetite, and marked thirst. He had lost 24 pounds during the six months preceding examination.

About two years earlier, or more, the patient's femur had become "lopsided," which the patient claimed was a sudden happening (?). The change was almost as marked then as it was at examination. Shortly after this the patient complained that his legs were heavy and weak, the right more so than the left. He had been told two years earlier that he had Paget's disease.

The family history was negative. The patient had always been in good health ex-

cept for an attack of lumbago, two years before hospitalization. He had a chronic infection in both ears and had been deaf for over twenty years.

Physical Examination.—The head was of peculiar shape, sloping in the frontal regions. The eyes, nose, and mouth were negative, as were the neck, lungs, and heart. The abdomen was soft, exhibiting no rigidity. The lower extremities showed definite bowing of the femurs and tibias; the arms showed no deformities though there was some thickening of the humerus on deep palpation. Knee jerks were absent.

X-ray Examination.—Examination made on Aug. 22, 1930, showed the skull, right humerus, left humerus, and both femurs and tibias to have undergone the typical changes of osteitis deformans.

Further examination showed disturbances of the trabeculæ of the lumbar spine and bones of the pelvis, with some evidence of cystic formation and bizarre deposits of calcium so characteristic of osteitis deformans. The patient's blood calcium varied between 10.5 and 10. There was no Bence-Jones protein in the urine.

The patient remained in the hospital until Sept. 6, 1930. Calcium lactate and viosterol were prescribed, to be taken in a similar manner to the other cases. He was still being treated late in 1930 and showed then some slight improvement.

Case 22. Mrs. K. B., a white woman, 50 years of age, was admitted to the hospital with a chief complaint of swelling and pain in the right leg and marked headaches which had been present for two or three years. Her physical examination was negative except for some apparent thickening of the bones and a slight bowing of the tibia, and the radiographs showed the typical changes of osteitis deformans. Her blood calcium was 12.3. The other examinations were entirely negative.

May 22, 1928.—The patient was given calcium lactate, 40 grains, twice a day; calcium hyperphosphate, 30 grains, three times a day, before meals. She returned one week later, saying the pains in her legs were much lessened and the headaches had entirely disappeared. Medication was continued and oscodal added.

June 19, 1928.—The blood calcium was 10.4 and the sugar 96. Medication was continued but, because of nausea, the oscodal was dropped. One month later the blood calcium was 10.8. Calcium hyperphospate was continued and other medication stopped.

Nov. 20, 1928.—The patient complained of "sticking pains" everywhere, and weakness on exertion. Strychnine sulphate, 1/30 gr. three times a day, calcium lactate, and tomato juice were given.

May 21, 1929.—Medication was continued and the patient improved steadily.

Nov. 12, 1929.—The patient complained of pain in the head and neck and tenderness in the right leg. She had gained in weight, but had not been taking medication for two months.

Dec. 10, 1929.—The patient felt much better. The headaches, pain in the leg, and stiffness were no longer apparent but she experienced considerable effort in moving about. Viosterol, gr. 30, was given twice daily and other medication was discontinued.

July 1, 1930.—But for slight pain in the right leg, the patient felt very well. Calcium lactate was given, and viosterol was continued, alternated with milk and tomato juice every other day. The patient's progress was satisfactory.

Case 23. J. G., a white male, 50 years of age, was admitted to the hospital in June, 1922, entering with a history of fracture of the femur sustained by a twisting motion and not by direct violence. The injury was seemingly trivial but resulted in a fracture.

X-ray Examination. — Examination showed a fracture of the femur accompa-

nied by the changes typical of osteitis deformans. The fracture healed without difficulty.

The patient was re-admitted in March, 1930. The history between the previous and present admissions was of no significance except that the patient complained of bone pains and disability when walking. He was unable to stand straight. He also had had considerable pain in his back and had noted stooping and decrease in his stature. These changes had been very gradual during the four years preceding the present examination. Eight days earlier he had awakened with severe pain, which lasted for two hours, in the hip and lumbar region. This severe pain soon subsided but a continual ache persisted for that day. No numbness or other changes were noted except deafness in the right ear.

Physical Examination.—The patient was a fairly well-nourished individual of slightly vacant facial appearance and stooped posture. He had a very large head and his face was slightly triangular. The legs showed no apparent bowing, the back was slightly bent, the sternum prominent, the lumbar region flattened, and the teeth rather poor. The neck showed no glandular enlargements. The heart examination was negative, the lungs, clear; the abdomen, negative. All reflexes were present.

X-ray Examination.—Radiographs made on March 4, 1930, showed the bones of the lumbar spine, hip joints, and pelvis to have that lacy appearance of bone with bizarre calcific deposits scattered throughout, and some cystic formation, which is typical of osteitis deformans. The old healed portion of the upper part of the shaft of the femur was clearly seen. There was also bizarre arrangement of the bone trabeculæ.

All laboratory tests were negative. The patient had low blood calcium content and was referred to Dr. Bernheim's clinic for treatment.

Case 24. Mrs. T., aged 50 years, who was referred to the hospital for radiographic examination, had been a missionary in the Philippine Islands for years. For a considerable period of time she had suffered from what she termed "rheumatism" for which she received varied medication without relief. A complete history of this case was not secured owing to the fact that the patient was referred for radiographs only and left for the Philippine Islands shortly after the examination. She has since been heard from through her physician, who states that her condition is becoming progressively worse. Her pains are about the same, but her disability is increasing and she finds walking correspondingly difficult.

X-ray Examination.—The films showed changes in the bone to be a fibrous cystic degeneration. The bone trabeculæ were arranged in longitudinal bundles, and were mottled by areas of decreased density, indicating absorption of calcium, and also a suggestion of beginning cystic formation. The rather unusual feature in this case was that the hands showed an involvement in one of the first metacarpal bones. The skull showed no evidence of the changes of Paget's disease.

Due entirely to the lack of involvement of the skull, this might be classed with Case 26 as a doubtful case of osteitis fibrosa cystica of the generalized type; however, the authors do not feel that this lack excludes Paget's disease. Due to the patient's age and the fact that her symptoms have been present for not more than six or eight years, it would seem that this is a case of Paget's disease without involvement of the skull.

Case 25. F. D., aged 41 years, while walking fast, fell over a low table, causing a fracture of the left femur. For about six months previous to the injury he had noted in the right leg a slight pain in the nature of a soreness which he could not sharply

localize; he thought it was probably rheumatic. The pain seemed to disappear when he exercised. Previous to the injury he had felt tired and slightly under par; he also had had continuous headaches for some six months. There was no family history of similar pains; the father died of rheumatism; the mother, of shock. The patient had had uniformly good health save for childhood diseases and occasional attacks of tonsillitis. His personal history was irrelevant.

The patient presented slight bowing of both legs, particularly of the femurs, and since he had sustained the fracture he had had to walk with a cane. His left knee was slightly limited in motion but there was no stiffness of the hip. Apparently his height had not undergone change. His skull showed slight thickening over the occipital protuberance and was rather large and square in appearance, but the face was fat, so that it did not have the typical triangular appearance.

X-ray Examination.—Radiographs revealed marked osteitis of the left femur, with the pathologic fracture; in addition, the bones of the pelvis and the upper half of the right femur were similarly involved. Also, changes in the lumbar spine and the posterior portion of the skull in the occipital and occipitoparietal regions showed definite thickness, with abnormal distribution of the trabeculæ. In the parietal regions there was a suggestion of a beginning typical appearance, as described by Baetjer. These findings were interpreted as due to Paget's disease.

Summary.—This case shows essentially the same X-ray findings as were noted in the following case, but here the skull did show changes, so that again the question arises as to which classification should be applied. One school would claim that this was unquestionably a case of Paget's disease because of the involvement of the skull. The other school would claim that there is no case of true osteitis deformans without the involvement of the skull, yet the changes in the long bones, the pelvis, and the spine in this case and the one following are very similar.

Case 26. H. P., aged 52 years, was admitted to the hospital on July 13, 1915. On the evening of admission the patient was standing on a window-seat 18 inches above the level of the floor. He was holding a heavy curtain, and, in attempting to step from the window-seat to the floor, his foot slipped and he fell to the floor, from which he found it impossible to rise. He had very little pain but knew from the deformity that his thigh was broken. The patient had always felt that the right leg was not so strong as the left; when he was a child he had noticed that he could not do things with the right leg which he could with the left. When he was about 30 years of age, he had had an accident, with resulting contusion of the right leg. Later two abscesses developed near the tibia, which necessitated treatment for two months, during most of which time he was confined to bed. The patient said that for some seven weeks previous to admission he had had rheumatism and pain in the bone in his right thigh, the pain being especially severe in the anterior muscles over the middle third of the thigh. The pain was made better by resting and was less severe at night. There was also more pronounced weakness in the right thigh than previously. He walked with a slight limp, and used a cane because he felt the leg could not support him. The past history was otherwise negative and the family history was irrelevant.

Physical Examination.—The examination was negative except for the right leg, which showed no evidence of contusion or external violence. The limb was held in external

rotation. There was marked anterior bowing just above the middle of the thigh, and extreme tenderness in this region. A mass was felt, apparently the upper fragment of the fracture, which was palpable anteriorly. A corresponding mass was felt posteriorly. There was crepitus on motion. The right leg was one inch shorter than the left.

X-ray Examination. — Examination showed pathologic fracture of the right femur, with bony changes indicating an osteitis. These changes consisted in a disturbance of the bone trabeculæ, osteoporosis, and cystic formation in the cortex and medulla, with some evidence of periosteal bone production and a widening and bending of the bone.

The patient was afebrile throughout the course of his convalescence from the fracture. His urine was practically always normal and his blood count showed nothing unusual. The fracture healed satisfactorily and the patient was discharged as cured on Nov. 4, 1915.

On Jan. 1, 1916, the patient was readmitted with the following history. A few minutes before admission, while he was getting off a train, his crutch slipped, and he fell a distance of two steps, striking his right heel with considerable force. His thigh became very painful at the site of the old injury and there was an apparent deformity. On admission, the deformity and swelling were clearly seen, and tenderness was apparent. The history was as recounted above on the previous admission.

X-ray Examination.—At this time the films showed a recent pathologic fracture at or near the site of the previous fracture, the changes being the same as in the previous examination except that the condition seemed still more advanced and was complicated by callus formation about the old fracture. Nothing else of interest was found in the history. The patient was discharged on February 9 with a firmly united fracture.

Oct. 17, 1916, he was again admitted to the hospital with another fracture of the right femur near the site of the two previous pathologic fractures. There was nothing further of interest in his history except that this fracture was sustained, as in the previous instances, with a minimum amount of trauma, namely, that he missed one step and the resulting jar caused the injury. The X-ray examination at this time showed distinct advance in the pathologic changes in the bone, and the left tibia showed the changes noted in Paget's disease. His blood calcium was never estimated. The blood count was normal, as was the urine analysis. The blood pressure was within normal limits for a man of his age.

Summary.—This is one of those cases in which it is a question as to what classification is to be applied. The X-ray examination and the patient's history show an osteitis involving numerous bones of the body. The condition is progressive, as the patient was again examined roentgenographically in February, 1927.

This case, however, has never had involvement of the skull. Also, the patient has given a history of slight disability in his right thigh since childhood, including abscesses on the leg. The question arises: Is this case one of so-called osteitis fibrosa which the patient had for some forty years before sustaining pathologic fractures and in which the skull has never been involved? On the other hand, are we to class this as a case of osteitis deformans without involvement of the skull, and are we to consider that the previous disability and weakness of the right thigh and the previous infection were in no way related to the present bone disease? It seems that this case is one of those that simply cry out for further investigation.

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RADIATION TREATMENT OF UTERINE HEMORRHAGE OF BENIGN ORIGIN[1]

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ELEVEN years ago last January, I began to treat certain selected cases of uterine hemorrhage by radiologic methods. The early cases responded in such a uniformly satisfactory manner that in a short time we were using radiation in a fairly large number of cases that had formerly required major surgical operation for relief. In this paper I wish to present briefly a study of some of the difficulties encountered, the methods used, and an analysis of the end-results of the whole series. Due to the fact that the management varies a great deal with the type of case, I wish to divide them into three groups.

1. Young women under 35 without tumor or other demonstrable pelvic disease who resisted conservative treatment and continued to bleed excessively. In this group there are 10 cases the records of which are complete. This type of patient was studied carefully, medical measures and curettage were tried before radium was advised, and it was only in the exceptional case that we found the use of radiation necessary. The treatment of this type of case consisted of the intra-uterine application of small doses of radium—200 to 400 mg.-hrs. being sufficient. The results have been uniformly good. All patients have been promptly relieved of their excessive bleeding and there have been no unpleasant complications. One patient returned after a period of five years with excessive bleeding, and she is at present under observation.

2. The second group includes the patients who were near or past the usual age for the menopause, who had no demonstrable tumor or inflammatory disease to account for their hemorrhage, but who continued to bleed excessively in spite of conservative medical management. Their condition is commonly styled hemorrhage of the menopause and is said to be due to fibroid of the uterus or metritis or endometritis. In this group of patients there are 31 cases, with an age range of from 40 to 57 years. The treatment of this type of case differs considerably from the others, since the only object of treatment is control of the hemorrhage. Small doses of radiation are usually all that is needed, and X-rays and radium act equally well. The average dosage of radium is 1,000 milligram-hours. One cycle of X-ray therapy is usually sufficient. The following case was exceptional, and the only one in this group that presented any unusual difficulties.

Mrs. H., age 57 years, consulted me on October 26, 1926.

History.—For several years her periods had been irregular. Twenty-two months previous to examination she began to bleed, and continued to flow in small amounts. She complained of pain in the back and legs. She gave no history of other illness except an occasional attack of asthma. She had never been pregnant.

Physical examination, aside from evidence of a considerable degree of anemia, was quite negative. Vaginal examination disclosed a retroverted uterus, but normal in size. There was no other pathology found in the pelvis. The cervix appeared normal. X-ray therapy was advised and monthly doses of moderate voltage X-ray were administered. The bleeding promptly ceased but recurred in small amounts at irregular intervals.

Her subsequent history reads as follows: "March 1, 1927 (five months after starting treatment).—Had a slight hemorrhage a few days ago. Has had very little bleeding the past two months. Examination negative.

[1]Read before the Cascade County Medical Society of Great Falls, Montana, March 21, 1931.

"August 10, 1927.—Has brownish discharge, slight bleeding at irregular intervals. Examination negative.

"October 28, 1927.— Slight bleeding past few days.

"January 17, 1928.—During past month the patient has had considerable bleeding. Curettage and radium treatments were advised. Pathologic report, endometritis. Results, complete cessation of bleeding."

This patient was quite well for one year following X-ray therapy except for occcasional slight bleeding. She declined further treatment until hemorrhage again became severe. The end-result was entirely satisfactory and she has remained well to date.

3. The third group is composed of the fibromyomas and in this group there is still room for study and discussion as to the best mode of treatment. In January, 1931, Dr. E. H. Zweifel, of Munich, in his Mayo Foundation Lecture entitled "Treatment of Fibromyoma by Roentgen Rays," says: "Ten years ago when I wrote a paper on this subject, I thought the discussion practically finished, but it is not, even yet, and further experience has led me to open the discussion once more." He states as his conclusions that irradiation of myomas is the treatment of choice. With careful diagnosis and selection of cases, it presents the least risky way to recovery.

Francis Carter Wood, in the *Journal of the American Medical Association,* March 1, 1930, says: "Many uncomplicated fibromyomas are still removed surgically which could perfectly well be treated by X-rays. The advantages of X-rays are lack of risk, simplicity of treatment, certainty of results, and low cost to patient."

Certain cases are undoubtedly best treated by surgical operation, while others can be definitely placed in the group in which radiation is the treatment of choice. In the borderline cases in which the complete diagnosis is in doubt, there will always be a divergence of opinion as to the best form of therapy. Such divergence of opinion is at the present time great. One prominent gynecologist states that the treatment of fibromyomas by X-rays is useless and exercises a harmful effect on the general endocrine activity and metabolism. He recommends panhysterectomy in all cases, but admits a mortality of 5 per cent. Certain German gynecologists irradiate a very large percentage of their cases. A prominent French authority (Béclère) made the statement that a myoma of the uterus always constitutes an indication for radiation therapy. During a seven-year period, at St. Luke's Hospital, New York City, 1,443 myomas were operated upon. During the same period, 20 cases were referred to the Radiotherapeutic Department for treatment. In the gynecologic service of the University of Pennsylvania, during a five-year period, 681 cases were treated. Of these, 428 were treated by surgery, and 253 by radiation. Our records show a total of 288 cases treated since we began to use radiation treatment. During this same period, 20 uterine fibromyomas were operated upon by Dr. Movius. There has been no mortality in this entire group.

In deciding which type of case is best operated on, it is generally agreed that very large, necrotic, or calcified tumors are best treated by surgical removal. Pedunculated and submucous growths are at times resistant to radiation and may constitute an indication for surgery. Tumors occurring in comparatively young women, in whom it is possible to preserve the major portion of the uterus, are best treated by surgery.

Less than two years ago I was asked see a patient who had a large fibroid. She was about 40 years of age, had been married only a short time, and was very anxious to have a child. I advised operation, which was performed. This patient is now near term and has every indication that her pregnancy will terminate successfully. Radiation would almost certainly have destroyed her reproductive function.

Mention may be made at this time of one patient who came under my care in 1927. The woman, who was 35 years of age, had a fibroid the size of a small orange, and had had severe hemorrhages. She was given two moderate dosage X-ray treatments which controlled her bleeding. Last April (three years after treatment) she was referred to me by the late Dr. Thuerer for examination of her abdomen to determine the nature of a large abdominal tumor. X-ray examination disclosed the presence of three fetuses. Unfortunately she aborted at approximately the fifth month. No evidence of any fibroid tumor could be found.

The question of a possible malignant growth being present in addition to the myoma is one that must have due consideration. Carcinoma of the body of the uterus is best treated by complete hysterectomy, and the radiation commonly used for fibromyoma will have little or no effect on carcinoma. The incidence of carcinoma complicating myoma as drawn from extensive pathologic records is about 0.5 per cent. It is our experience that carcinoma can usually be excluded by a careful history, as the bleeding from carcinoma is as a rule slight, irregular in character, and accompanied by a watery discharge. Diagnostic curettage is used only in doubtful cases and followed immediately by radium treatment. We have not, to our knowledge, treated any cases of carcinoma under a mistaken diagnosis of myoma. Sarcoma complicates myoma in less than 1 per cent of all cases examined pathologically, which is considerably less than the average operative mortality from hysterectomy. We have had no experience with this condition. Of the 268 cases treated, 22 were between 50 and 60 years of age, 202 between 40 and 50, and 67 under 40. Of these, 24 had tumors classed as very large, extending well up into the abdomen, in several instances reaching as high as the umbilicus; 244 had intrapelvic myomas of which 162 were classed as large, *i.e.*, practically filling the pelvis, and 82 were small, about the size of an orange. Symptoms, aside from hemorrhage, which was present in most cases, were pain, pelvic and abdominal, in 41 cases; backache in 50; shortness of breath in 10; severe headache in 30. In two patients, pressure on the bladder was sufficient to interfere with urination. In that they did not complete the treatment as outlined and went elsewhere for operative treatment, 6 patients are classed as incomplete. One patient, whose history is as follows, was a failure as far as radiation treatment was concerned.

Mrs. J., age 42 years, complained of profuse menstruation which had begun 18 months previous to examination. The flow had lasted from 8 to 14 days, and at the time she came for treatment she had been flowing for three weeks. On examination, a myoma the size of an orange was found. X-ray treatments were given in October, November, and December, 1927, and January, 1928, with very little effect. She was advised to have a curettage and intra-uterine radium treatment, which were done, but the bleeding continued, and hysterectomy was finally performed. The examination of the uterus showed a small submucous fibroid about the size of an egg, very hard and fibrous in character, which apparently acted as a foreign body. This patient made an uneventful recovery.

Another patient who was resistant to X-ray therapy was Mrs. C., referred by Dr. Armstrong. She was a woman past 50 years with a tumor that nearly filled the pelvis. Her periods were heavy, and she had a moderate degree of anemia. X-ray therapy was started in January, 1926, twelve X-ray treatments being given during the year. The excessive bleeding promptly responded to the treatment, but she continued to menstruate a small amount. At the end of the year, I urged diagnostic curettage and radium treatment but these were declined. Dr. Armstrong said the tumor had disap-

peared and he saw no reason for further treatment. This patient's menstruation ceased entirely after a few months and she has since remained well.

There have been two cases in which the size of the tumor has not been satisfactorily reduced and operation has been performed for removal of a large tumor, after the hemorrhage had been controlled and the patient's general condition markedly improved.

In order to meet the needs of the individual patient, the methods of treating myoma by radiation are necessarily varied. Severe bleeding usually calls for a moderate dose of radium as this will almost invariably cause a prompt arrest of the hemorrhage. When the tumor is large it is necessary to follow the radium treatment with moderate doses of X-rays at intervals of from ten days to two or three weeks, over a period of about three months or longer, in order to secure a satisfactory reduction in the tumor. Until 1928, a large portion of my cases were treated with an old type 10-inch machine which I have since found will deliver only 100 K.V. at the altitude in Billings. A few cases have been treated with voltages as high as 200 K.V. and filters of 0.5 mm. copper. There is apparently very little advantage in the larger doses and higher voltages as far as the tumor is concerned and the patient does not tolerate the higher voltage so well. My present technic consists of 150 K.V., 0.25 mm. Cu, about 300 r applied alternately to front and back every ten days. I usually give eight or more treatments. This plan of treatment causes the patient to experience little or no reaction or inconvenience of any kind. Patients who live a long distance from Billings are usually advised to take 1,600 mg.-hrs. of radium in order to minimize the number of trips necessary to secure satisfactory results. Patients are re-examined after six weeks of treatment, and at monthly intervals thereafter. Treatment is continued until the tumor has been reduced at least 50 per cent in size, and longer, if the size of the tumor appears to be causing symptoms.

That a gradual reduction of the size of the tumor goes on for a long time after treatment is discontinued has been repeatedly proved by our own observation. One of my early cases was a striking illustration of this. This patient had a large, hard fibroid reaching nearly to the umbilicus. Treatment promptly stopped hemorrhage and the tumor became smaller. After about seven months of treatment the patient was practically symptom-free. Reduction in the size of the tumor was estimated at about 40 per cent. The patient moved away at this time but she returned for observation after one year. During this year she had had no treatment. Examination at this time showed a complete disappearance of the tumor.

Skin reactions are few, and cause little or no trouble. Some patients complain of nausea, but this is less since we have shortened our treatment time. The usual nervous manifestations of the climacteric are to be expected, apparently differing little or none from those seen at the natural menopause. Many patients ask the question, "Won't this treatment make me an old woman?" My reply is that, on the contrary, it is the best method we have of rejuvenation.

SUMMARY

A total of 309 cases of uterine bleeding have been subjected to radiation treatment. One case resulted in complete failure. In two cases the bleeding was controlled, but subsequent operation was necessary for removal of the tumor. Six cases discontinued treatment before a complete series had been administered. In 300 cases a satisfactory result has been achieved.

RADIOTHERAPY WITH SMALL QUANTITIES OF RADIUM

A PRACTICAL TECHNIC

By PAUL O. SNOKE, M.D., LANCASTER, PENNSYLVANIA
From the X-ray Department of the Lancaster General Hospital

THOSE radiologists not working in the large centers frequently feel that the practical and clinical aspects of radiotherapy are being forgotten by those concerned with scientific research. The practising radiologist is concerned with clinical results and the manner in which they may be obtained with his small quantity of radium. We deem it timely to correlate the highly scientific with the practical aspects of the problem. Unfortunately in many reports the statistical data so hide the technic of treatment that, though one reads his periodicals, he still fails to appreciate the necessary details.

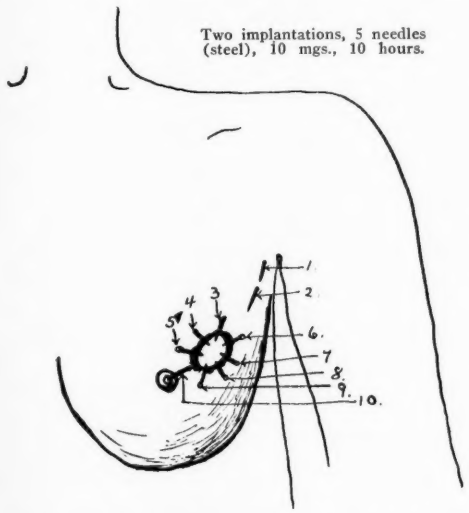

Fig. 1. Mapping of carcinoma of the left breast, 4.5 × 3 × 3 centimeters.

If we study these periodicals we find that Forssell (1) and Berven and Heyman (2), in Stockholm, and Bowing (3), at the Mayo Clinic, are achieving the same percentage of five-year cures in carcinoma of the cervix that Norris (4), at the University of Pennsylvania, with a different technic, is securing. It would seem that the amount of radium available has very little to do with the results, but, rather, that the manner of its application is all-important.

We have available at the Lancaster General Hospital 75 milligrams of radium, these limited resources making it necessary to prolong the treatment time—not a disadvantage, as Regaud has shown. We do not use in every case the heavy filtration he advocates, but attempt to vary it, increasing the filtration as the depth of the lesion increases.

If we, as practical radiologists, can select a technic using small quantities efficiently, we can achieve as brilliant results as have been obtained in the centers devoted to scientific investigation, with the splendid advantage of individualization. We venture to report our methods in the hope that they may aid in the adaptation of scientific fact to practical therapy.

INTERSTITIAL RADIATION

Before undertaking any radium implantation the lesion is mapped and measured (Fig. 1). From a sketch made at this time the location of each needle is predetermined, also fatty tissue and bony structures are considered. The needles, measuring 1.5 mm. × 2.7 cm., with a wall thickness of 0.4 mm. steel, are so arranged that their points are 1.2 cm. apart after insertion. They are implanted in one plane unless the lesion is so thick that two planes are required. This is rarely the case, for we can resort to radial implantation, using the tumor as a hemisphere or sphere, pointing the needles toward the center.

The patient is given a general anesthetic, preferably gas. Local anesthesia is disadvantageous because of the danger of opening lymph channels for metastatic invasion. Block anesthesia is very good, but it is not applicable to all locations. The skin is prepared as for a major operation and all aseptic precautions are observed. A bistoury is used to incise the skin, and through this small incision the needle, held in a needle holder as a spearhead on a spear, is plunged directly into the carcinomatous mass. Trocar and cannula are used in very deep lesions in which one must traverse normal areolar tissue (Fig. 2).

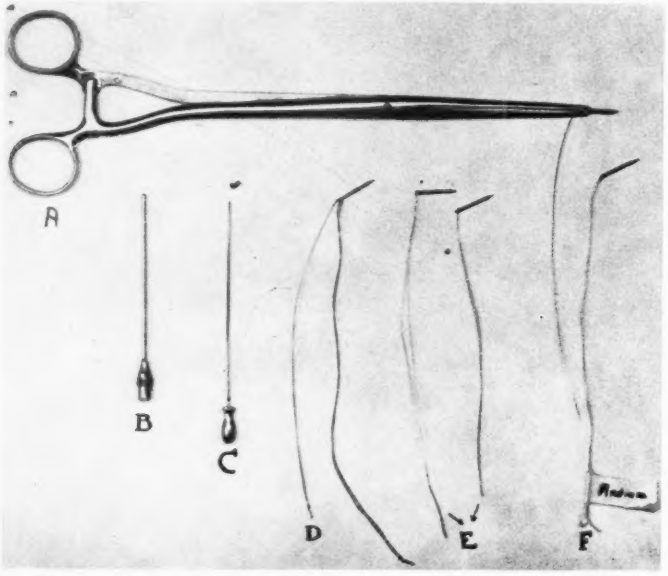

Fig. 2. *(A)* Needle holder, with needle in position for implantation; *(B)* Cannula; *(C)* Trocar—note the flat sides which permit egress of the wires; *(D)* Needle threaded with black silk and wire; *(E)* Two needles threaded with wire; *(F)* Needle threaded with white silk for superficial work.

We attempt to reach the palpable border of the neoplasm, embedding one-half the needle length in the neoplasm. This serves to hold the needle firmly and catches outlying groups of carcinoma cells. We are not unmindful of Handley's microscopic growing edge, but, in view of its uncertain location, depend upon subsequent irradiation to control it.

Our needles are threaded with fine non-corrosive wire; this in preference to silk thread, which is uncertain because it breaks too easily and in most embarrassing situations. In intra-oral work the needles are threaded with wire and black silk. With the silk they are sewn *in situ*. In treating large lesions in which more than five needles are necessary, the implantation is done in two stages, re-implanting upon removal.

Each of the needles contains 10 mg. and is permitted to remain *in situ* ten hours, *i.e.*, 100 mg.-el. hours.

DANGERS AND EXCEPTIONS

Needle implantation is never undertaken through an ulcerated or infected surface. Intra-oral work requires chemical sterilization of the field before insertion. Infection carried into the depths of an actively

growing carcinoma is certain to lead to increased rapidity of growth.

Displacement of a needle after insertion is a serious matter, as proximity to the skin for the full time will cause a severe burn. prevent this misfortune. Occasionally in implanting radium needles a sensory nerve lies along the course of the needle and receives maximum radiation. This causes most excruciating pain of months' duration, for

Basal-cell carcinoma of the left hand, 2x1.4 cm., 25 mg. radium, 0.5 mm. Ag tube, four positions, three hours.

Fig. 3. Superficial carcinoma of the hand, mapped after biopsy.

As a precautionary measure the wires projecting through the puncture wounds are fastened with adhesive plaster, sterilized in a lamp, at their point of exit through the skin. Dressings and bandages are applied over this. Care must be exercised in implanting if nodules are subcutaneous—the time must be reduced or the needle implanted deeply so that the lesion lies between the needle and the skin.

Fatty tissue and bone must not be heavily irradiated if avoidable. There is danger of fat necrosis and bone devitalization (5), both of which are unpardonable sins. Only painstaking care and good judgment will which resection of the nerve alone affords relief.

Tonsillar lesions require 80 mg.-el.-hrs. as the lymphoid tissues are usually radiosensitive and there is danger of sloughing and hemorrhage. The grading of the dose is a matter of judgment which depends on the type of growth and its comparative radiosensitivity. Only a few reports are available which are of scientific value, notably Quimby and Martin's (6). Modern therapy demands this type of work.

Although we are using steel filtration, we contemplate changing to platinum, 0.5 mm. wall thickness. The increased filtration re-

duces the beta radiation, and we are very certain that gamma radiation is more to be desired than beta.

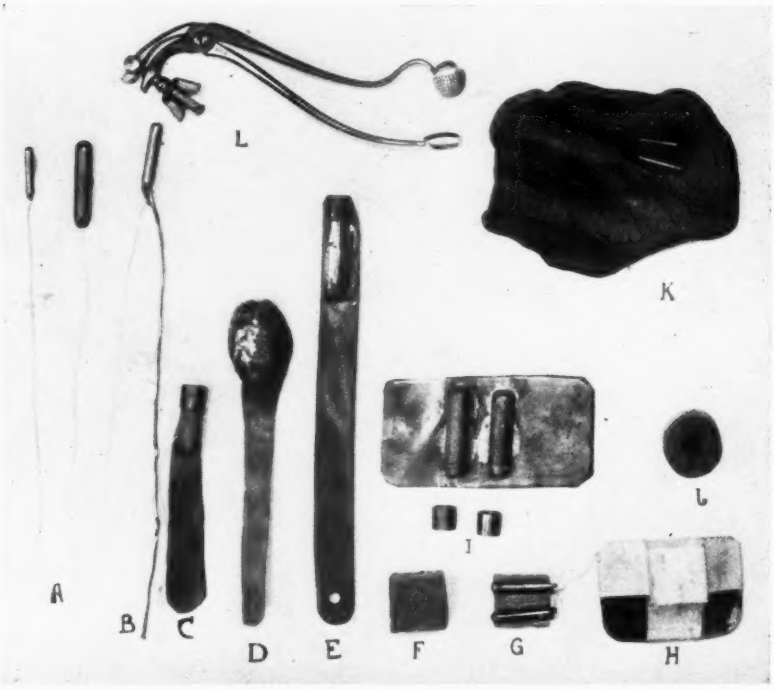

Fig. 4. *(A)* Small capsule 0.5 mm., silver filter for 25 mg. glass capsule, large capsule, 2 mm. of brass for five 10-mg. needles; *(B)* Capsule for five 10-mg. needles, wall thickness 1 mm., one brass wire, and silk for cervical work; *(C)* Lead capsule for intra-oral work, 3 mm. wall; *(D)* Lead spoon for palatal applications; *(E)* Lead capsule with handle for deep intra-oral lesions; *(F)* Cork block 2.5 × 2.5 cm., 2 cm. thick; *(G)* Two brass capsules on a cork block 1 in. thick; *(H)* Wooden block 2.5 cm. cube on a celluloid base; *(I)* Two lead capsules 3 mm. wall thickness for deep-seated lesions; *(J)* Cervical cork for vaginal applications; *(K)* Moulage of irregular lesion distal to hypothenar eminence—lesion painted black, dummy tubes of wire visible; *(L)* Tonsil clamp, for topical applications to tonsil and adjacent structures.

SURFACE RADIATION

After having observed bare tubes, gold tubes, and steel needles generously implanted in carcinomas, we are convinced that the indications for interstitial radiation are daily becoming more circumscribed. We feel that operative interference with inoperable carcinoma opens avenues of infection, lowers the resistance of the host, and damages local resistance. Attention need only be called to cases of metastatic malignancy in the cervical lymph nodes, *e.g.*, from a primary lesion of the tongue. Occasionally the surgeon attempts a block dissection of the neck but on exposure finds that nodes apparently free-lying before operation are hopelessly embedded, making resection impossible.

Our experience has been that although these patients get primary skin union the neoplasm takes on added malignancy and the termination is hastened, in spite of the fact that only the skin and superficial fascia have been disturbed. In such extensive dis-

ease external radiation offers the best chance for control. Interstitial radiation would require multitudinous emanation implants evenly distributed. A trial of this method suffices to convince one that the homogeneous distribution of radiation in three planes is indeed theoretic.

Surface radiation has great possibilities, more especially so since the introduction of high filtration. Forssell (7) classifies lesions of the skin as superficial and infiltrating. This is applicable and may be carried with advantage to other locations. Further clarity may be secured by subdividing these two as follows:

(A) Superficial
- Ulcerating
- Non-ulcerating

(B) Infiltrating
- Ulcerating
- Non-ulcerating

Superficial Non-ulcerating Lesions.—These are best treated with a filtration of 0.5 mm. Ag and 1 mm. of rubber. We do not wish to produce ulceration by our treatment, therefore we encase our 25 mg. silver capsule in rubber tubing—wall thickness, 2 mm.—which serves to remove the secondary radiation of the silver. Silver, 0.5 mm., removes 25 per cent of the beta radiation, the remaining 75 per cent and the gamma rays being effective. The erythema time is 50 mg.-el.-hours.

The silver tube is applied to skin lesions with adhesive plaster. The lesion is measured, mapped, and photographed, and a time plan of radiation made (Fig. 3).

Superficial Ulcerated Lesions.—These are treated with the naked silver tube, and, as before, it is applied on adhesive plaster or a moulage, after mapping. This radiation is the most caustic used in treatment.

Although the erythema time is 35 mg.-el.-hrs., we routinely give 75 mg.-el.-hours. Quimby's erythema (8) is a faint blush on the skin of 80 per cent of a group of normal individuals after fourteen days. In treating carcinoma, we are not satisfied with "faint blushes"—we desire maximum effects compatible with reparative processes, *i.e.,* the epidermicidal dose. We omit the rubber because the ulcerating carcinomatous surface affords this filtration for the deeper structures which we wish to treat, and aids by destroying superficial cells by caustic lysis.

Dangers.—The application of radium in this form adjacent to cartilage, *i.e.,* the ear, will give rise to a perichondritis. This is painful, very difficult to heal, and always to be avoided. In locations in which cartilage is subjacent, surgical diathermy offers the superior method of treatment.

Because repeated small doses have a tendency to produce a chronic ulcer with a fibrous base, it is important to avoid them. This is evidence of inadequate primary treatment, and the resulting type of ulcer is malignant, non-healing, and unresponsive to any type of therapy. Electrocoagulation offers the best chance for cure. Surgical intervention results almost invariably in a severe cellulitis or erysipelas. The malignant cells seem to be enmeshed in a fibrous matrix, the growth impulse held in abeyance; insufficient nourishment reaches the surface so that infection cannot be coped with nor healing occur. A disturbance of this symbiotic community leads to rebellion and the rapid increase of one or the other element; failure to attack the lesion leads to slow but sure malignant progress.

Infiltrating Ulcerated Lesions.—With the quantity of radium at our disposal we can prepare a 50 mg. capsule, wall thickness 1 mm. or 2 mm., and a 25 mg. capsule with the same wall thicknesses. Higher filtrations can be obtained by having lead capsules made. We are using 3 mm. of Pb.

Capsules are used primarily in the infiltrating lesions, being encased in 2 mm. rubber tubing when they are used in contact. Experience alone can aid one in a decision

as to when to apply capsules in contact and at a distance. In general, however, in lesions of the mouth or in body cavities, they must perforce be used in contact, whereas in surface lesions space is available for distance therapy.

Various applicators are available for intra-oral work, of which the lead spoon, the center-board holder, and the tonsil clamp are the best known (Fig. 4).

With 1 mm. brass, 2 mm. rubber filtration, the erythema time is 64 mg.-el.-hours. Practically, we give 100 mg.-el.-hrs. plus. This dosage can be repeated every other day until 400 to 600 mg.-el.-hrs. are given. The reaction is very severe, requiring six weeks for healing. With these intra-oral applicators, fixation cannot be rigid, so that the area treated is not accurately computable; this accounts in a large measure for the huge dosage one may give with comparative safety.

Lesions situated about the eye necessitate protection of the eyeball. Lead plates 2 mm. thick are cut to fit the conjunctival sac, hammered until they fit the curvature of the eyeball, smoothed, and polished until they are flawless. After cocainizing the eye these are slipped into the conjunctival sac before the treatment is started.

RADIUM IN THE CERVIX UTERI (CARCINOMA)

The naked 1 mm. brass capsule containing 50 mg. is used with a semi-flexible brass wire through its eye. This is inserted in the external os after biopsy and chemical sterilization of the surface. The vagina is packed tightly. The knee-chest posture aids greatly and an intra-vaginal light is indispensable. The dose is 50 mg. given for 16 hours, a total of 800 mg.-el.-hours.

After 48 hours, a second application is made and, if the canal is patulous, the 25 mg. capsule in brass precedes the large capsule in an attempt to reach the fundus. The 50 mg. capsule is placed in a midcervical position. Again 16 hours is given. A third similar treatment is given after the 48-hour interval, the total intracervical dosage being 2,400 mg.-el.-hours. If the 25 mg. capsule will enter the fundus, an additional 800 mg.-el.-hrs. may be added to this.

Vaginal applications follow at 48-hour intervals. A cork 2.5 cm. in diameter is bored to take a 50 mg. lead capsule of 3 mm. wall thickness. This is used in the three positions—right, left, and across, or the H series. The erythema time is 800 mg.-el.-hours.

This is the technic advocated by Bowing (3) with modifications and is excellent for those who possess only small quantities of radium.

Infiltrating Non-ulcerating Lesions.—These are treated by radium packs and moulages. The greatest distance compatible with duration of treatment and efficiency is 3 centimeters. There are those who would use the convenient and better distance of 4 mm., but with only 75 mg. of the element the time is too long. For the sake of convenience, we use distances of 1 cm., 2 cm., and 2.5 cm., or one inch. All areas are blocked out in carbolfuchsin or ink in 2.5 cm. squares. All corks for treatment are cut 2.5 cm. square.

The erythema time at 1 cm. with 1 mm. brass filter, 2.5×2.5 cm. area, is 294 mg.-el.-hours. We give 600 to 800 mg.-el.-hrs. in one week.

Upon increasing the distance to 2 cm., we increase the time to 350 mg.-el.-hrs.; whereas at 2.5 cm., 500 mg.-el.-hrs. can be given.

Moulages may be made of Columbia paste or dental compound. Regaud believes Columbia paste produces secondary radiation which is advantageous. Columbia paste can be made in any laboratory, is inexpensive, and is very easily handled. For irregular or inaccessible lesions this is an ideal

Fig. 5. Parotid tumor before radiation.

Fig. 6. Lesion mapped for radium therapy.

Fig. 7. Radiation response. Erythema three weeks after the last radium application.

method of treatment. At the Radium Institute in Paris the smaller moulages are saved, and the location of the radium tubes indicated by thick wire. Should the patient develop a recurrence, its location is compared with the moulage so that the defect in treatment may be corrected in subsequent cases. The paste is warmed in hot water until soft, gently applied to the surface or lesion. Cold water is used immediately upon its removal to chill it so that it retains the shape of the lesion. Distance can be secured by planting the tubes on the exterior of the moulage in grooves made by a hot wire.

COMBINED RADIUM AND X-RADIATION

The use of two types of radiation over the same skin area is not new, but is productive of excellent results and deserves wider use than it now enjoys. Rather than go into an elaborate discussion of theory and methods we will report the treatment as actually given in a case of parotid tumor.

The parotid tumor, which measured 4 cm. in diameter, was raised 2.5 cm. from the normal facial contour (Fig. 5), covered with distended venules, slightly reddened, hot to the touch, and firmly fixed to the deep structures, but not to the skin. There was no lymphadenopathy, and the routine laboratory examinations were negative.

The X-ray treatment was given first—eight treatments in a period of sixteen days—rising by 30 per cent doses to 90 per cent, maintaining this figure plus or minus 5 per cent for the period. The total radiation was 335 mam., 140 K.V., 5 ma., 4 mm. Al filter, at a skin-target distance of 40 centimeters. The area covered the cheek, adjacent neck, and ear.

With the before-mentioned factors the erythema time was 175 mam.: the machine has been calibrated by J. L. Weatherwax. The 335 mam. dose is 191 per cent of an erythema dose.

A fortnight later, radium therapy was instituted. At this time a small sinus had opened in the center of the tumor mass, but no pus or secretion discharged. It presented the typical appearance of malignant ulceration with rolled edges.

Ten areas (Fig. 6), each measuring 2.5 sq. cm., were laid out over the neoplastic area. A square cork, 2.5 cm. on each side, was cut 1 cm. thick and to the superficial side of this the two brass capsules of 50 and 25 mg., respectively, were strapped. Wall thickness 1 mm. brass. Each area was numbered and treated in rotation for three hours, *i.e.*, 225 mg.-el.-hours.

On the eighteenth day after the radium treatment, the patient had a severe erythema with desquamation, but no blistering. The sinus was closing and the pain relieved (Fig. 8). On the thirty-second day the erythema had diminished, evidencing a tendency to browning and early desquamation. The center of the tumor was shrunken and sclerotic, the periphery was a hard fibrous mass one-third the previous size.

Quimby (8) reports on the theoretic aspect of combined radiation; Widmann on the clinical application of two types of radiation. It is beyond the scope of this paper to discuss the theory—suffice to say the results are far superior to one type of radiation in selected cases.

SUMMARY

Small quantities of radium may be used to great advantage by an experienced, well-trained, and ingenious radiologist.

A detailed review of methods now in use in this laboratory is given, omitting statistics and striving for simplicity and clarity.

The apparent simplicity of these methods should not becloud the fact that a great deal of wisdom, tact, and experience are necessary in their use, and that the tyro will fail if he attempts it.

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TWO UNUSUAL CASES REVEALED IN ROUTINE ROENTGENOGRAPHY[1]

By C. C. OWEN, M.D., San Bernardino, California

OCCASIONALLY in the smaller communities an odd case is accidentally disclosed during the process of a roentgen examination.

In the cases considered at this time, the first is a regular routine examination of the nasal accessory sinuses in a boy, nine years of age, which showed, in addition to the sinus and nasal pathology, a striking fold of increased density intracranially in the left parietal area. The second was an X-ray examination for a suspected fracture of the left clavicle in an infant, nine months of age, which showed no evidence of a fracture, but a suspicious shadow in the left thorax resembling the gastric saccule, without a definite shadow of the cupola of the left diaphragm.

Case 1. H. A., aged 9 years. Height, 4 feet 2 inches. Weight, 66 pounds. Pulse, 80. Temperature, 98.6. Blood pressure 114/76. The boy, of well nourished and healthy appearance, was of the phlegmatic type. His father, whose health previously had been good, had died at 26 years of age of sinus thrombosis following an infected third molar. The mother, aged 32 years, was living and well.

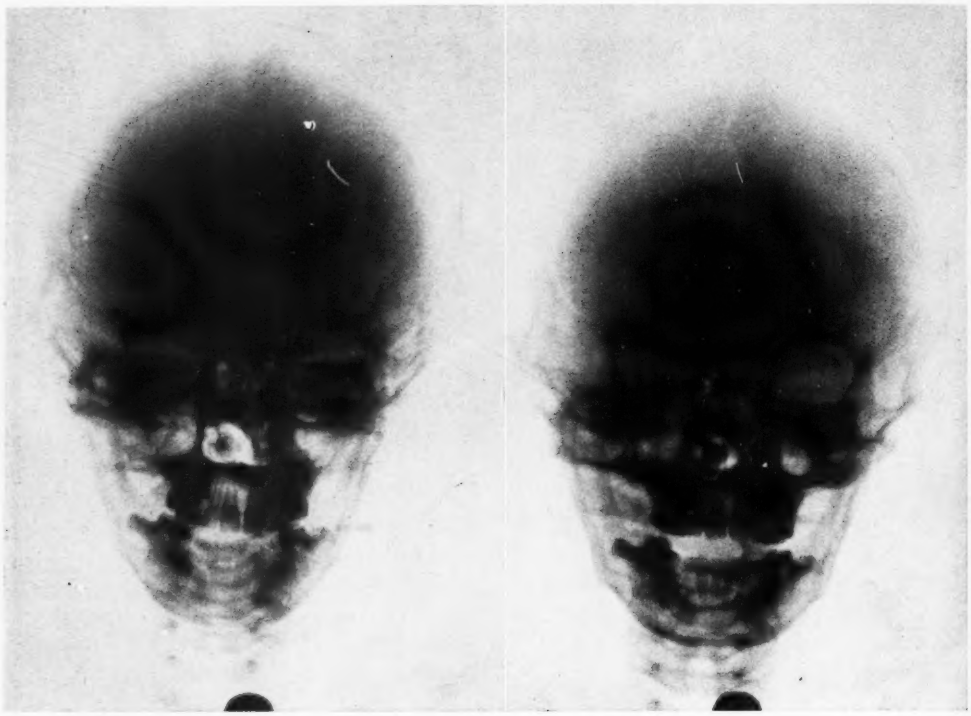
Personal History.—Malnutrition in infancy, scarlet fever, whooping cough, mumps, chicken pox, pneumonia. There was no syphilitic history and the Wassermann test was negative.

There was no history of injury at birth. During infancy there was a period of malnutrition at six months, with some convulsive attacks. At that time there was a noticeable increase in the size of the cranium, but no definite history of a true hydrocephalus or meningitis is obtainable. There is an indefinite history of a scalp laceration in the frontal region at six years caused by a falling object. The boy's health had been apparently good, with the exception of the usual diseases of childhood, as enumerated above, until two years previous to examination, when the headaches began. They were accompanied by a sense of pressure in the left parietal region and frequent attacks of epistaxis. The mother noticed a seeming retardation of the mental development also.

Roentgen Findings.—On Aug. 25, 1930, the first roentgen examination was made, following complaint of nasal accessory sinus pathology causing chronic headaches, epistaxis and occluded nasal passage on the left side, and lethargy. The films of the first examination are not available, but at that time there was a definite increase in density involving the right antrum, marked deviation of the nasal septum to the left, with occlusion of the left nasal passage and poorly defined anterior ethmoid cells. In addition, there was a striking fold of increased density apparent in the left parietal area, intracranially, which was obviously abnormal and stimulated interest on account of the headaches and sense of pressure in this region.

A second roentgen examination was made Sept. 9, 1930. The same sinus and nasal pathology was demonstrable, and in the different views of the skull the increased density noted was more apparent and better demonstrated. There was a definite increase in the size of the calvarium in relation to the face and mandible. In the postero-anterior view, taken at 107 degrees, the widest horizontal diameter was 19.7 centimeters. The fold of increased density on the inner

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1–5, 1930.



Figs. 1 and 2. Postero-anterior views of the skull in Case 1, showing increase in the size of the calvarium and fold of increased density on the inner surface of the cranium. (See text.)

surface of the cranium in the left parietal area extended from 2 cm. left of the sagittal suture to the left mastoid area, being about 1.3 cm. at the thickest part. The tables showed no definite bony production or destruction and the fold was not of the density of calcium; it was apparently a soft-tissue shadow. The antero-posterior view of the occipital area showed this density more distinctly, and here it measured 1.8 cm. at the thickest part. The lambdoidal sutures and the inner table of the skull were well defined and apparently intact in this view. The fold was accentuated by a channel of decreased density which seemed to communicate with the middle meningeal groove, especially in the postero-anterior views, in which the longitudinal sinus was visible and apparently dilated.

In the left lateral view of the skull, the occipito-frontal diameter was 20.1 centimeters. The inner table was well defined and there was a triangular area of increased density at the vertex, just posterior to the bregma, with the base at the groove for the middle meningeal vessels and the apex touching the inner table in the left parietal area about 5 cm. posteriorly. It was 2 cm. wide at the base. The groove for the middle meningeal vessels was very definite and apparently widened, at least more so than usual, and it seemed to invade the inner table at the vertex. This increased density and the wide meningeal groove were not apparent in the right lateral view of the skull. (This film, as well as the films of the first examination, was lost when the case was referred.)

These findings show definite evidence of a pathologic lesion intracranially, suggestive of a thickened fold of dura mater coincident with a probable aneurysm involving the middle meningeal vessels, and dilatation of the longitudinal sinus demonstrable at this examination.

Operative Findings.—This case was referred to Dr. Cecil Reynolds, of Hollywood, for diagnosis and treatment. After finding neurologic evidence of intracranial pressure in the area noted, the pre-operative diagnosis was an old, organized, extra-dural hemorrhage. The operation consisted of the fashioning and turning downward of a left parietal osteoplastic flap. Very severe bleeding from a large vessel passing to the bone from a dilated lacunal varix was encountered, also from a slight tear in the large ascending abnormal dural vein, running directly up to the varix. Muscle grafts were placed on each of these bleeding points as the brain pressure, which was at first markedly excessive, gradually diminished. Cotton pads had to be placed over the grafts to hold them *in situ*, and the flap temporarily replaced with silkworm-gut. The enlarged dural vein was tied in two places below the varix.

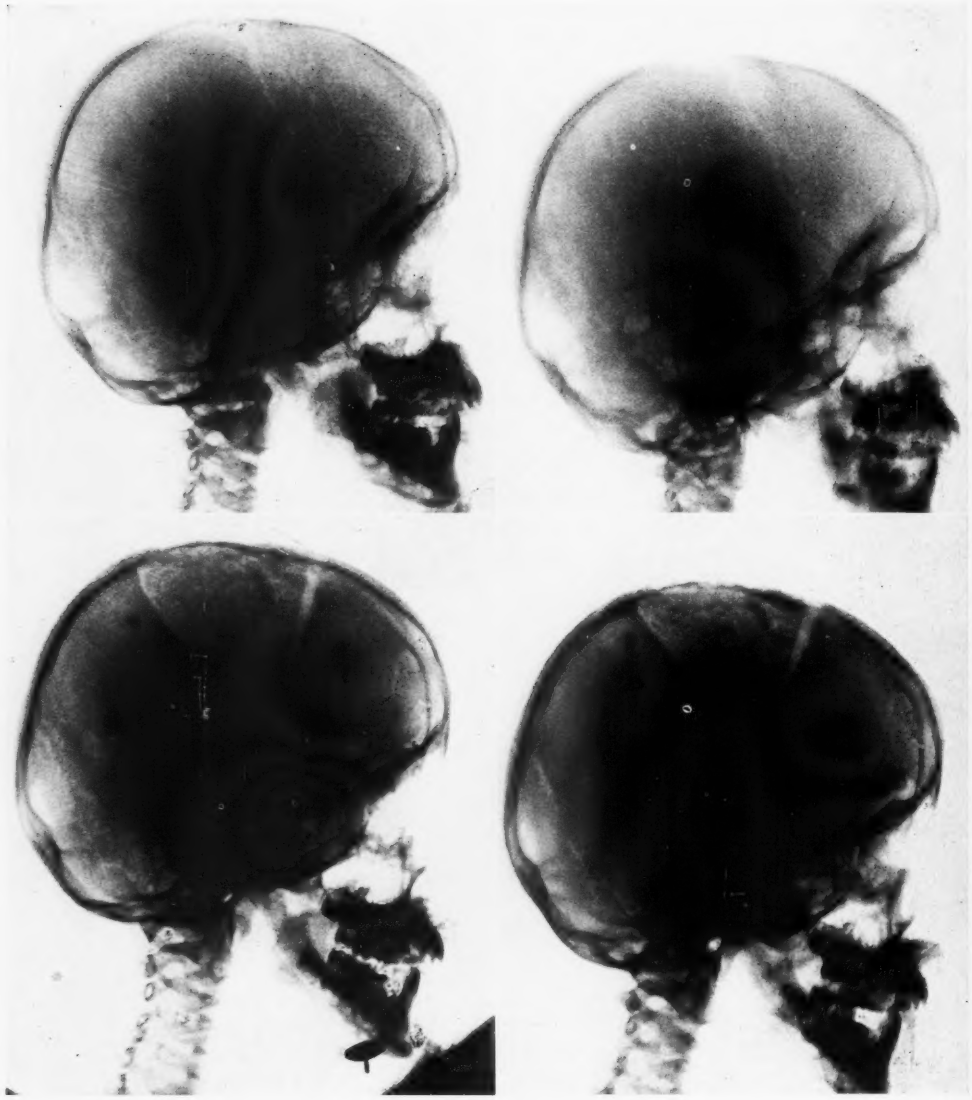
Post-operative Diagnosis.—Diagnosis was of a varix connected with the longitudinal sinus, secondary to an internal hydrocephalus. The following day the flap was turned downwards, the cotton pads soaked off with saline, and the grafts pressed on firmly. The flap was replaced, after all the blood was cleansed, with two cigarette drains (Penrose) projecting through each drill hole to drain the surface of the dura. The dura was never opened. The thickened dura was thought to be the result of an early inflammation of the meninges.

Differential Diagnosis.—The lesions most commonly found affecting the external surface of the brain are the arterio-venous and venous malformations, as stated by Cushing and Bailey, which are primarily surface lesions of the hemispheres. Types may be recognized as simple enlargement of a single vessel, one or more vessels, or complicated racemose types. The lesion extends from the cerebral surface, like an inverted cone with the apex abutting a ventricle, into which a terminal hemorrhage sometimes occurs (3).

Fig. 3. Case 1. The dense fold here measures 1.8 cm. at its thickest part.

Meningiomas or endotheliomas, formerly believed to originate from the dural surface, are now believed to originate from the arachnoid and to comprise about 12 per cent of intracranial tumors. There is usually irregular bone proliferation from the lesion extending and squeezing into the crevices and bone spaces, irritating the bone. Erosion, vascularity, bone changes, spicule formation, diffuse thickening, enlargement of the meningeal channels, and calcification are the results of these lesions (20).

Syphilis with headache, the commonest symptom, usually shows marked osteoperiostitis, circumscribed, multiple, or single, in



Figs. 4, 5, 6, and 7. Lateral views of the skull in Case 1, showing the area of increased density at the vertex and the groove for the middle meningeal vessels definitely widened. (See text.)

the cranial dome. The transparencies of gummas are usually round or oval.

Tumors of the soft tissues of the skull—angiomas, fibromas, dermoid cysts, and lipomas—may produce deformities of the skull, but they rarely produce new bone. They usually cause bone atrophy from pressure, while malignant growths may infiltrate the bone or cause pressure atrophy.

Injuries of the skull and its contents form hematomas and aneurysms due to arterial injury, and cause atrophy from pressure. Concussions, contusions, or laceration of the brain, membranes, or vessels from

trauma may result in brain changes not demonstrable by the roentgen ray unless calcification has resulted.

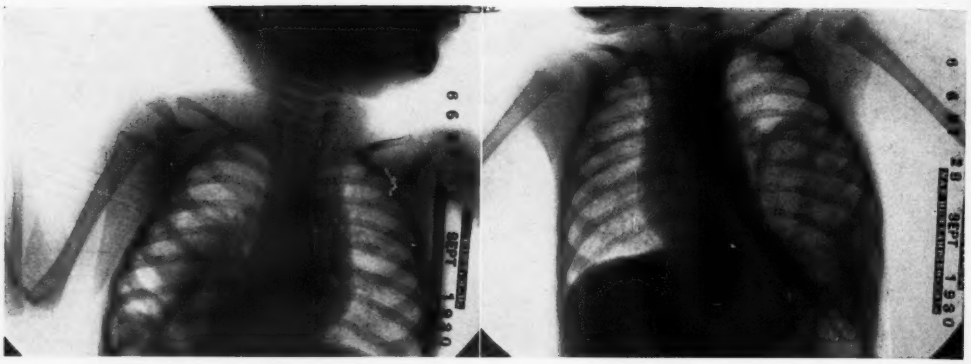
The inflammatory changes following meningitis, brain abscesses, arterial aneurysms, and brain tumors, which are sequelæ to injury of the cranial contents, may show evidence of thickening or calcification. Hydrocephalus, *Cysticercus* cysts, tubercles, gummas, encephalitis and scars of contusions result in calcification, producing local destruction on the inner surface of the skull and intracranial pressure. Hydrocephalus is the most common cause of change in the contour due to intracranial pressure. Migraine may result in asymmetrical changes in contour, and with increased pressure the sutures may be thinned out and show elongated dentations and erosions or calcification (18).

Conclusions.—In this case intracranially there was a thickened fold of density with an apparent dilatation of the longitudinal sinus, and widening of the venous channel markings in the left calvarium, suggesting a dural thickening with venous changes. This was confirmed by operation. The extra-dural varix was considered secondary to an internal infantile hydrocephalus, and the meninges thickened as a result of early inflammatory reaction. The evident antrum and nasal pathology suggests a remote cause for the inflammatory induration, but should be considered incidental. Syphilis was eliminated as a cause with a negative Wassermann reaction and the absence of a syphilitic history. If the condition had not been discovered accidentally, the prognosis would have been serious, but, as a result of the operation, the headaches have disappeared and the boy is active, brighter, and enjoying good health at this time.

A re-examination two months following the operation showed the osteoplastic flap with callus from the periosteal proliferation uniting it firmly at the anterior and posterior borders. There is still some drainage from the scalp wound and edema of the soft tissues, but the flap appears viable and intact.

Fig. 8. Case 1. Anteroposterior view taken at a 30-degree angle, 26-inch distance.

Fig. 9. Case 1. View of the base of the skull made without the Potter-Bucky diaphragm; 30-inch distance.



Figs. 10 and 11. Postero-anterior views in Case 2, showing elevation and fixation of left diaphragm with resultant high position of the stomach and splenic flexure.

Case 2. F. S., an infant aged nine months, was well nourished and normal in appearance. He was examined Sept. 28, 1930, for a suspected fracture of the left clavicle following a fall from a high chair two days previously. The parents had noticed a limitation of movement of the left shoulder, and the child cried when it was moved. There was no definite evidence of a fracture demonstrable, but there was a suspicious shadow in the left thorax resembling the gastric saccule, the splenic flexure was high, and the dome of the left diaphragm was not easily demonstrable. The heart, mediastinum, and left lung were displaced considerably toward the right. Physical examination showed some dullness in the left thorax, and there was a depression in the left costochondral margin which was apparently congenital. The apex beat was in the midline. There was no history of trauma except the recent fall from a chair. There had been gastro-intestinal symptoms of colic, and feeding difficulties, with regurgitation at times, which had been corrected by proper feeding formulæ.

Fig. 12. Another postero-anterior view of the thorax, Case 2.

The following day, the child was immobilized by being wrapped in a sheet; one ounce of barium sulphate was added to the regular bottle feeding at ten o'clock, and administered under fluoroscopic observation.

Roentgen Findings.—The barium mixture filled the esophagus, which descended as a straight column, normally, slightly to the right of the vertebral shadow, to a point opposite the eleventh dorsal vertebra, where it entered the stomach. The fundus was apparently at the level of the third rib anteriorly on the left side; above this there was an unbroken curved arch of increased density identified as the diaphragm. It was

apparently elevated, but did not seem to move with respiration. The movements of the right diaphragm were very definite as the child was crying. Observation in the lateral position and the left lateral oblique showed the distinct curved line of the diaphragmatic cupola, with the stomach in the thorax below it.

Fig. 13. Right and left lateral views in Case 2, showing the heart, mediastinum, and left lung displaced to the right.

Several views were taken which showed the stomach filled with barium high in the left thorax, with barium in the esophagus entering at the usual level of cardiac orifice. The margin of the left diaphragm can be traced from the middle of the tenth dorsal vertebra upward, left of the vertebræ to the level of the fourth rib posteriorly. The heart and mediastinum were displaced to the right, and the dome of the right diaphragm was at the level of the tenth rib posteriorly. The lateral views show the left dome distinctly at the level of the fourth rib, with the anterior and posterior attachments, while the right dome was at the level of the tenth rib.

A postero-anterior view taken at the end of fifteen minutes showed the esophagus empty, the stomach filled with barium, and the diaphragm above the stomach, with a peristaltic wave at the pars media. There was some barium entering the small intestine at the distal end of the greater curvature, but a definite pylorus and duodenum were not demonstrable.

A six-hour view showed about a 50 per cent gastric residue in the lower portion, then a gap and a vertical dilated loop, resembling the second portion of the duodenum. There was gas in the descending colon and the splenic flexure was high.

A 24-hour view showed no gastric residue. There was an irregular residue of barium in the transverse colon extending from the right iliac fossa obliquely and upward to the left, with the splenic flexure

Fig. 14. Anteroposterior view, after 15 minutes. Case 2.

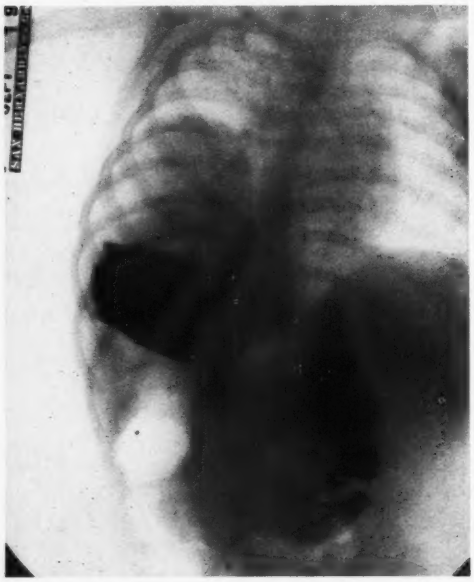


Fig. 15. Postero-anterior view, after six hours, Case 2.

filled with gas and high in the thorax. The dome of the left diaphragm remained elevated in the thorax. There was a small residue of barium in the descending colon near the sigmoid with the remainder in the distal colon and rectum.

Differential Diagnosis.—According to Le Wald (11), certain congenital and acquired conditions of the diaphragm are classified as follows:

(1) Absence of left half of diaphragm
(2) Thoracic stomach
(3) Eventration of the diaphragm
(4) Congenital hernia
(5) Acquired hernia

(1) Absence of the left half of the diaphragm can be diagnosed by roentgen examination and roentgenograms, especially in the lateral view. A correct diagnosis of this condition is important, particularly in regard to the risk of surgical intervention, which is contra-indicated if the diaphragm is absent. A lateral view reveals the absence of a regularly curved or arched line of the diaphragmatic dome, which if present can be traced to its attachments.

(2) Thoracic stomach can be demonstrated by the roentgen examination and shows the stomach in the thorax, with the diaphragm perfect in form below it and intact on both sides. No surgical intervention is necessary unless some gastro-intestinal complication occurs.

(3) Eventration of the diaphragm may occur on either side, but is usually on the left side. It may assume a high level and should always show an even curved outline, especially in the lateral view. Contrast opaque mixture is often necessary to differentiate the upper border of the stomach from the leaf of the diaphragm. It is usually due to atrophy of the musculature or secondary to phrenic nerve disease, and is sometimes very difficult to differentiate from diaphragmatic hernia with a sac, even with barium mixture or pneumoperitoneum —especially if the muscle fibers are exceedingly thinned out, or the sac presents an uneven curved line. However, a sac usually

shows a broken line and some angulation. True eventration is irreparable and permanent (6).

(4) A defect in the diaphragm at birth (congenital hernia) may allow the abdominal contents to escape into the thorax on either side. Identification of the diaphragm shadow is important, as hernia is operable.

(5) Acquired hernia may result if the esophageal orifice is weakened or relaxed, with an escape of a portion of the stomach through it. Identification of the hernia with barium and a distinct outline of the diaphragm are necessary, as this is an operable condition.

Voluminous literature has arisen on the differentiation between eventration or elevated position of the diaphragm and diaphragmatic hernia, because the difference is often difficult to determine. Both are departures from the physiologic, and are considered by some authorities to be different phases of the same trouble (8). A constant roentgen finding rather indicates eventration, while a variable condition suggests hernia. Eventration is regarded etiologically as congenital and is irreparable. There is also a difference in opinion regarding the movements of the elevated diaphragm. Holmes and Ruggles (6) state that the movements are limited although normal, while in hernia the outline is obscured and the movements paradoxic. Paralysis of the phrenic nerve also presents paradoxic movements. Moore (14) says that the movements are reversed and that true eventration is rare, although since the use of the X-ray more cases are being discovered.

Ritvo (15) states that congenital weakness of the musculature of the diaphragm is the probable determining factor in hernia, while eventration shows an elevation of the diaphragm with resultant high stomach, splenic flexure, and small intestine.

Barium shows the esophagus rarely tortuous, which disappears with reduction. It is usually angulated at the orifice.

Fig. 16. Postero-anterior view, after 24 hours, Case 2.

Rusconi (16) denies the paradoxic movements or that pneumoperitoneum has any diagnostic value, and that eventration and hernia may have identical pathologic, anatomic, and clinical manifestations if the hernial ring is large. The arched line may be the sac in true hernia; in false hernia and congenital absence the herniated viscus and lower boundary of the lung, and in eventration the relaxed atrophied diaphragm. If the hernia is limited and the sac visible, the diagnosis may be made.

Elevation due to pressure from below or traction above is usually temporary and not true eventration, according to Stoloff (19), who says that, notwithstanding the X-ray, eventration and diaphragmatic hernia remain uncommon, but that a smooth rounded dome, sharply defined—since the continuity is not disturbed—is probably eventration and not hernia. Pneumoperitoneum will outline the leaf inferiorly, but with hernia the gas rises to the upper limit of the herniating mass, indicating absence or limit of the diaphragm, while an angulation above

the mass suggests hernia. All the facts must be avai'able, and even then a differentiation is sometimes impossible, according to Schönfeld (17), and errors are easily made (14).

Conclusion.—In this case the esophagus was apparently straight and not tortuous or shortened, while there was an apparent congenital anomaly of the stomach and duodenum, with elevation and fixation of the left diaphragm and resultant high position of the stomach and splenic flexure in the thorax. The heart, mediastinum, and left lung were displaced toward the right side, and there was an unbroken distinct arched line of the elevated diaphragm demonstrable in both postero-anterior and lateral roentgenograms when the contrast mixture filled the stomach. These findings, in the absence of a history of definite early trauma or clinical symptoms, rather indicate the condition to be one of true congenital eventration of the diaphragm, and an anomaly of the stomach, not amenable to operation unless some complication arises.

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HEPATOSPLENOGRAPHY

ROENTGENOLOGIC DEMONSTRATION OF THE PARENCHYMA OF THE SPLEEN AND LIVER BY MEANS OF A NEW INTRAVENOUS CONTRAST MEDIUM (THOROTRAST)

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IT IS a great privilege to report herewith a new method by which the liver and spleen are made roentgenologically visible following intravenous administration of a colloidal contrast medium. The results obtained in a series of cases in which this method was used will be described.

The possibility of direct visualization of the liver shadow was suggested by the visualization of the gall bladder obtained by Einhorn (1), following administration of tetraiodophenolphthalein, and the use of tordiol later suggested for hepatosplenography by Oka (2) and Radt (3). This new colloidal contrast medium is not precipitated by the organic fluids and has been used for retrograde pyelography. After experiments on animals controlled by anatomic studies made by Dr. J. Rossier (4) in the Pathologic Institute of Prof. M. Askanazy, a clinically applicable method was developed which makes possible the roentgen visualization of the liver and spleen without risk to the patient. The author (5) has used this method on patients in Prof. M. Roch's University Clinic for Internal Medicine.

Thorotrast is a 25 per cent thorium dioxide sol containing 22 per cent of metallic thorium. It has a bluish, milky, shimmering appearance in reflected light. In transmitted light it appears as a clear, brownish fluid. For intravenous use it is diluted at least ten times with 5 per cent glucose solution, sterilized by heating, and injected in increasing doses in the course of several days. To determine the patient's tolerance, an initial dose of not more than 0.1 gr. of thorotrast per kilogram of body weight is given. After that, each dose is increased from 0.1 to 0.05 gr. per kilogram of body weight until the desired dose is given, care being taken not to exceed the patient's tolerance. As a rule, a total of 0.8 gr. of thorotrast per kilogram of body weight is enough to produce an intense shadow on the roentgen film, the density of the

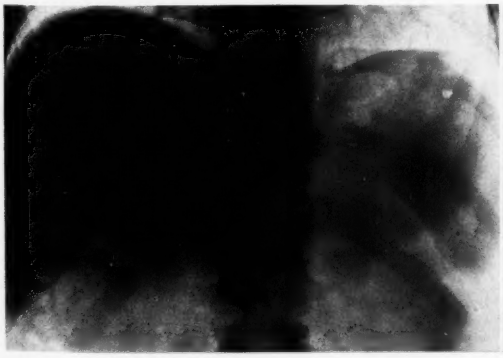

Fig. 1. Hepatosplenogram of a normal liver and somewhat hyperemic enlarged spleen. (Rays directed vertically, patient lying on abdomen.)

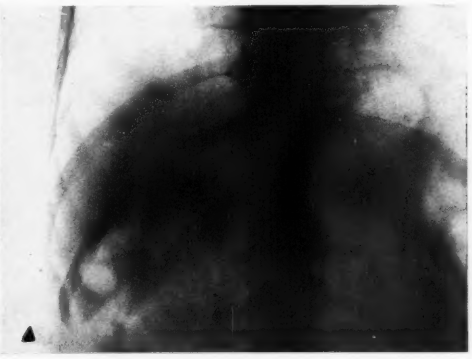

Fig. 2. The same case: radiograph of the abdomen before injection.

Fig. 3. Hepatosplenogram of an ectopic, vertically elongated liver and a normal spleen. (Margins indefinite due to movement; patient in a stupor.)

Fig. 4. The same case with patient on her back. Due to abnormal mobility, the liver has assumed a horizontal position under the diaphragm.

liver being approximately equal to that of the vertebræ, and the density of the spleen to that of the ribs (Figs. 1 and 2). In the event that visualization of the margins of the liver and spleen is all that is desired, one-half to one-third of the dose is sufficient.

Fig. 5. Hepatosplenogram in a large chronic permanent splenomegaly. There is absence of the spleen shadow. The somewhat enlarged dense liver shadow is displaced to the right and downward (dorsoventral view).

Roentgen observation should be made 24 hours after the last injection, and a flat dorsoventral plate of the upper abdomen, taken with the patient in the supine position, is ordinarily sufficient. If the organs are abnormal in structure or position, special views are necessary, using a definite technic (6). The patient lies on the abdomen and the rays are directed dorsoventrally at an angle of from 20 to 30 degrees toward the patient's head, so that the liver is visualized in its greatest transverse and smallest vertical diameter. In the event that there is an appreciable variation from the normal position, the direction of the rays is correspondingly changed so as to be perpendicular to the plane of greatest diameter of the liver.

Fig. 6. The same case: hepatogram in oblique position.

Fig. 7. The same case before injection. The greatly enlarged spleen displaced downward, the barium-filled stomach and small bowel. (Patient standing.)

The technic of Rieder and Groedel is applicable to the spleen.

The intense shadows of the liver and spleen are due to the storage of the electrically negative colloidal particles of thorium in the reticulum cells in the pulp of the spleen and in the Kupffer cells of the liver (of which from four to five containing granules are visualized in every microscopic field of histologic specimens). Some of the colloidal particles are also demonstrable in the bone marrow, lungs, and adrenals, but the resultant increase in density is insufficient to render them visible in the roentgenogram. After a limited time interval, no anatomic changes could be demonstrated in the tissues of experimental animals.

The injections are generally well borne, and, aside from occasional transient disturbances, no serious complications have occurred. In three cases there was vomiting, twice in patients with cirrhosis of the liver and once in a case of chronic nephritis. In a patient with a large chronic splenomegaly of unknown nature, there was a slight hemoclastic shock following the last injection, which was readily relieved by an injection of adrenalin. A fit of coughing was produced in an asthmatic patient.

The hemoglobinuria occasionally observed in guinea pigs has not once been observed in 25 injections in humans and was evidently due to faulty technic in the experimental animals. Blood studies showed a slight, transient diminution in the erythrocyte count. Liver function and other clinical examinations were entirely negative. Although the method gives precise information about

the topography of the liver, it is particularly indicated in those diseases of the liver or spleen in which circumscribed pathologic-anatomic changes take place. In cases in which the normal tissue is displaced by a shadow was obtained in a case of cirrhosis (8) in which the spleen was enlarged and cast a good shadow. The enlarged spleen was poorly visualized in a patient who had malaria (therapeutic), and there was a com-

Fig. 8 *(left)*. Radiograph of the liver of an experimental animal injected with very large doses of thorotrast.
Fig. 9 *(right)*. Radiograph of the spleen of an experimental animal impregnated with a large dose of thorotrast.

tumor mass, an echinococcus cyst, a circumscribed abscess, a syphilitic gumma, etc., the contrast medium is not absorbed, and a negative shadow is visualized on the roentgenogram, as Radt (7) demonstrated in two cases of cancer of the liver. As the various processes differ in their pathologic-anatomic picture, so also different and characteristic shadows are obtained. Care must be taken not to confuse gas in the intestine for intrahepatic negative shadows.

Disease processes which produce diffuse pathologic-anatomic changes in the liver and spleen seldom constitute an indication for the examination. For example, a poor liver plete absence of the spleen shadow in a very large permanent splenomegaly of unknown etiology.

The contra-indications are those pathologic conditions in which the colloidal contrast substance cannot be taken up by the reticulum cells and might produce injury due to its prolonged period of circulation in the blood stream.

After the rapid administration of very large amounts (15 to 20 times that ordinarily used) of thorotrast intravenously, the author found in guinea pigs that the reticulum cells of the liver and spleen were unable to absorb all the colloidal contrast

medium so that many granules were not only absorbed by the reticulo-endothelial cells of other organs but by the endothelial cells of the glomeruli of the kidneys.

There was hyaline degeneration of many glomeruli, and the liver cells assumed a necrotic appearance. The method should therefore not be used in patients with severe hepatic or splenic insufficiency, especially those in whom there is also some renal damage.

The picture in specific diseases of the reticulo-endothelial apparatus, for instance Gaucher's disease or lymphogranulomatosis, is still unknown, and it will be necessary to exercise great caution in their investigation.

Thorotrast, the supensoid which is used, is not toxic. Like other thorium-containing colloidal contrast media, it is not attacked by acids or alkalies even in high concentration. Blühbaum, Frick, and Kalkbrenner (9) injected thorium hydroxide sol subcutaneously in animals, and six months later were unable to demonstrate histologically any cell changes. The author's animal experiments similarly show that thorotrast produces no injurious effects unless it is given rapidly in large doses. With very large doses, the author and J. Rossier obtained osteomyelograms (Fig. 10) and nephrograms (Fig. 11).

Several months after injection of thorotrast, animals were found to be normal; two guinea pigs, one of which received massive doses, bore normally developed living young. Weight loss occurred only in animals which had received a much larger quantity of thorotrast than is necessary for hepatosplenography.

The excretion of thorotrast is very slow and the liver and spleen shadows produced by the contained thorium persist for a long time. Only after a period of several months is there an appreciable diminution of the shadow density. Probably a portion of the thorium is excreted through the lungs, since

Fig. 10. Experimental osteomyelogram in a guinea pig. Lateral view of the leg.

granules in appreciable numbers are always found in the endothelial cells of the pulmonary alveoli. The extent to which the liver and kidneys take part in the excretion is not entirely known.

The radio-activity of thorium is apparently too slight to produce any harmful effects in the comparatively short time it remains in the organism. In the Radium Institute of the Academy of Freiburg, umbrathor was investigated for its radio-activity. The thorium dioxide content of this substance is equal to that of thorotrast. One hundred c.c. of this colloidal sol contains a quantity of radio-active substance, the gamma-ray equivalent of which is that of the gamma rays of 1.24×10^{-6} gr. of radium. Since only 40 gr. of thorotrast

Fig. 11. Experimental nephrogram in a guinea pig.

are required to produce good visualization of the liver and spleen in a 50-kilogram individual, the total gamma-ray equivalent is that of the gamma rays of 0.496×10^{-6} gr. of radium.

Thorotrast is a preparation of non-toxic nature which, in contrast to umbrathor and tordiol, is unchanged by the action of the body fluids, as Weiser (10) has demonstrated. J. Rossier and the author have shown in animal experiments that it can be introduced into the blood stream without the production of capillary emboli. It should, therefore, achieve a sphere of usefulness not only in the limited field of medical roentgenology, but also in other branches of clinical medicine. It is more readily tolerated than the colloidal metals which have heretofore been used in medicine for non-specific therapy. Small doses could be used in the treatment of various acute or chronic diseases such as syphilis or tuberculosis.

Another phase that should be investigated is the sensitization of the cells to radiation therapy in the presence of tumors. The author noted a striking therapeutic effect in some of the patients he examined whose reticulo-endothelial apparatus was apparently normal. Two patients whose condition before injection was so poor that they were regarded as hopelessly incurable were greatly improved in a relatively short time.

CONCLUSION

It may be said that the above described method of hepatosplenography has given entirely satisfactory results from the roentgenologic, clinical, and anatomic standpoints, and has appeared harmless over a limited time. In many instances it was apparently of therapeutic value. Until it has been used in a larger series of cases and these have been observed for a longer period of time, it should not be used routinely, especially in young individuals. The indications at present are limited to cases of carcinoma, echinococcus cysts, and abscess of the liver and spleen, especially those in which there is a likelihood of subsequent surgical interference.

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New Super X-ray Tube Equal of World's Total Radium.—All the radium in the world could not make more intense rays for the treatment of cancer than the new 900,000-volt, cascade X-ray tube of the New York Memorial Hospital, Dr. G. Failla recently told his fellow-physicists at the meeting of the American Physical Society.

One and one-half inches of lead are easily pierced by the rays from the new tube, which was developed by Dr. W. D. Coolidge.

Danger to workers with this tube, run for several hours a day, is considerable, said Dr. Failla, in describing the protective means employed in the laboratory.

Running at 700,000 volts and five milliamperes, the radiation from the tube is equivalent to the rays from 600 grams of radium, the total amount isolated pure in the world. Some eight grams of this—more than anywhere else in the world—is located at the Memorial Hospital itself.

New methods of treating cancer victims were sought in these experiments, comparing the new X-rays with radium rays.

THE VIENNA RADIOLOGICAL SOCIETY

Session, May 5, 1931

Translation by Henry Riggs Wolcott, Chicago

Chairman, Professor Kienböck; *Secretary,* Dozent Fleischner. Professor Kienböck and Professor Schwarz expressed their thanks for having been chosen as chairmen of the Society.

THE TECHNIC OF IRRADIATION OF THE TONSILS

Dr. G. Schwarz: The subject of the technic of tonsillar irradiation has been brought again to the forefront of interest by several German publications containing comprehensive statistics. Several hundred cases with good results in from 80 to 90 per cent are reported. In 1911, Menzel, in addressing the Vienna Laryngologic Society, was the first to announce good results from roentgen irradiation in chronic tonsillitis. Through improvements in the technic it has become possible, in recent years, to improve the method. Going back to my last presentation of patients before the Gesellschaft der Aerzte, I wish to give some further details in regard to the technic. A correct technic is very important. Failures and good results tardily secured are due to unsuitable technic but are adduced to discountenance the method.

First, as to the shielding of certain parts. After various experiments, I have found that the simplest plan is to cut from the center of a protecting plate 18 by 24 cm. in size, an opening 5 by 7 cm. or 6 by 8 centimeters. This shield is applied in such a manner that the posterior margin of the submaxillary branch is barely covered (parotid gland); also the mandibular nerve and the larynx are protected. The patient assumes the supine position with the shoulders raised somewhat. The head hangs loosely and is turned to one side. Before the shield is applied, it is washed each time with concentrated alcohol. A field back of the mastoid process remains unprotected. The roentgen tube is so inclined that the central beam passes between the posterior margin of the lower jaw and the mastoid process of the side to be irradiated, and is directed toward the zygomatic process of the temporal bone on the opposite side. If one desires to include adenoid growths, the beam is directed a little higher toward the orbit of the opposite side. In the case of adenoids in children, the beam should be applied also to two fields reached from the back of the neck, with the patient in the prone position. This technic corresponds essentially to that employed by Holfelder and Lenk.

As to the dosage and the intervals between sittings, let it be stated that the single dose should be 3 H with a 0.2 zinc filter and 180 kilovolts. If the patients do not live [near], one can irradiate both sides once on three successive days, and the patient can then be allowed to return home. If the patients [do] reside [nearby], it is advisable to apply two irradiations each week, each side being irradiated three times. The single dose may in the latter event be increased to 4 H. If six weeks after the completion of the series of irradiations no evident effects are to be noted, another like series of irradiations should be applied. A third series of irradiations after a further interval of six weeks is likewise admissible.

It is advisable to furnish the patients with a statement covering the following points:

1. The retrogression of the enlarged tonsils begins usually after from four to six weeks and proceeds gradually.
2. During the first six weeks after the

irradiation, new attacks of sore throat may still occur.

3. Even in the cases in which the tonsils do not diminish much in size, the predisposition to attacks of sore throat is usually eliminated within a few months.

4. In about one-fifth of the cases the outcome of the irradiation is not a complete success, although some improvement can be expected in nearly every instance.

It should be stated that in children the retrogression appears to be more rapid than in adults. It is important that the roentgenologist be acquainted with these details. Medical radiology has here a mission to perform; for it is important (especially in those cases in which surgical intervention is contra-indicated) that a form of treatment should be available that eliminates sore throat and its effects, particularly since the lingual tonsils and scattered tonsillar tissue about the pharyngeal ring can be influenced, whereas it cannot be removed by a surgical operation. Every radiologist must thoroughly understand the technic and must also study diligently the scientific aspects of the problem, since opposition from various sources is to be anticipated.

DISCUSSION

With regard to the history of roentgen treatment of tonsillitis, K. M. Menzel stated that, taking as his point of departure the fact of the resorbent action of roentgen rays on lymphatic tissue, he began, as early as 1909, the systematic treatment of chronic tonsillitis by roentgen irradiation of the tonsils. A patient so treated was presented by [him] at the session of the Vienna Laryngologic Society, Dec. 6, 1911. The patient was a man aged 30, who complained of frequently recurring sore throat, thick speech, snoring, and dyspnea. Examination had revealed greatly enlarged tonsils, which were in a condition of chronic inflammation. The speaker asked Prof. Gottwald Schwarz, who was at that time the roentgenologic specialist for the sick benefit association, to undertake the roentgen irradiation of the patient's tonsils. At first the speaker planned to carry out the treatment by way of the mouth, and for that purpose had cylindrical metal tubes constructed which enabled the operator to confine the beam of rays to the tonsils and to shield the adjacent parts from the action of the roentgen rays. The patient was irradiated about ten times at intervals of fourteen days, the tubes just mentioned being employed. During this period of treatment, no striking effects of the intervention were observable. Not until Dr. J. Robinsohn undertook an irradiation of the tonsils from without, through the tissues overlying the two submaxillary angles, was an extensive shrinking of the tonsils brought about in September, 1910, with the result that the tonsils then presented approximately the size that the age of the patient would lead one to expect. A comparison of the condition of the tonsils before and after treatment showed a *reduction* in size equivalent to about three-fourths of the original volume. There are two things important to note: (1) That the tonsils, from the time the treatment was completed up to the time the case was presented, a period of more than one year, had not increased in size, and (2) that the formerly frequent attacks of sore throat had ceased since the beginning of treatment, a period of more than two years. Menzel closed his account with the statement that the method he had described appeared to be suitable for the elimination of not only tonsillar hypertrophy but also of the frequent recurrences of sore throat and peritonsillar abscesses that go hand in hand with chronic tonsillitis—especially in such patients as have an inordinate dread of operations or for whom tonsillectomy is contra-indicated because of the likelihood of severe

hemorrhages (hemophilia) or because of advanced age. Menzel had, later, several other patients with tonsillitis or with adenoid growths irradiated by Dr. Robinsohn. Although the results were reasonably satisfactory and the speaker still kept the subject in mind, there were three reasons why he could not continue to devote himself so intensively to the method: (1) Because the treatment, as shown by the experiences at that time, covered too long a period (about nine months); (2) because the results could not be judged with absolute certainty in view of the fact that, even in severe tonsillitis and frequent recurrences of inflammatory conditions, remissions extending over several years are observed, and (3) because, at that time, owing to the exaggerated trend toward tonsillectomy, the result of American influence, the radical operation on the tonsils was universally demanded.

The speaker considers the irradiation method for the treatment of tonsils as still applicable and capable of giving good results, and he welcomes the endeavors of Schwarz and Kriser, with whom he will be glad to co-operate, more especially as many of the disadvantages of earlier days no longer exist; for example, the duration of treatment has become much shorter; the results can be measured with some degree of certainty, and we are not all of us to-day so enthusiastic about tonsillectomy. Hence, the speaker thinks he is safe in assuming that the treatment of chronic tonsillitis and of tonsillar hypertrophy with roentgen rays has a favorable future.

Dr. R. Kienböck: The new procedure will without doubt gradually replace operative treatment, because it offers not only greater advantages but also promises permanent results.

THE VARIOUS CAUSES OF DRYNESS IN THE MOUTH

Dr. J. Borak: If after the irradiation of both sides of the face the sense of dryness arises in the buccal cavity, it would appear, from our physiologic conceptions, practically certain that it is due to the diminished secretion of saliva resulting from the reduction of the activity of the salivary glands brought about by the irradiation. It is unquestionably true that the roentgen rays may reduce the functioning of the salivary glands; but there are a number of observations that seem to indicate that the sense of dryness arising after irradiations is not caused in every case by diminished secretion of saliva.

First, it will be recalled that the feeling of dryness in the mouth arises in connection with various local disorders of the buccal cavity and the pharynx and associated with various general conditions, although there is absolutely no evidence of a reduced secretion of saliva in these affections.

If the buccal cavity lies within range of the rays, it is surprising that at times when the patient complains of a marked sense of dryness, which can be relieved only by the ingestion of large quantities of fluids, an objective inspection reveals that the buccal cavity is moist throughout; in fact, one sometimes even observes considerable saliva in the form of the well known long-drawn-out threads.

This discrepancy between the subjective sensation and the objective findings becomes still more striking when we are confronted with the task of reducing in an objectively demonstrable manner the secretion of saliva. Such actual problems arise, as is well known, in fistulas of the salivary ducts, in which the activity of a normal salivary gland must be entirely suppressed; furthermore, in certain sequels of nervous and cerebral disorders (for example, in Parkinson's syndrome), in which the increased activity of both salivary glands must be reduced to normal. When we have such cases to treat, we observe that doses which suffice for the pro-

duction of the sensation of dryness are by no means sufficient for an objectively demonstrable reduction of the activity of the salivary glands. As in the treatment of hyperhidrosis, the irradiations in the latter case must often be applied with a very high dosage. Moreover, in the treatment of hyperhidrosis we do not see why the patient should complain of dryness when the hands are objectively still moist.

With reference to the treatment for increased salivation, we have another instructive observation to report. One or two days after the irradiation, there develops a sense of dryness, which lasts about a week, but not until the sensation of dryness has entirely disappeared is an objectively demonstrable diminution of the secretion of saliva in evidence. This not only begins later but also continues longer than the sensation of dryness.

From all these observations one is forced to conclude that the sensation of dryness in the mouth is brought about not indirectly through the reduction of the activity of the parotid gland but, rather, through a direct influence of the roentgen rays on the mucosa of the buccal cavity. It is well known that there are in the mucosa many branches of terminal nerves. The sensation of dryness following the irradiation of the buccal cavity is doubtless due to changes in these receptive sensory terminals. Further support for this view is furnished by the observation that I had the opportunity to make last year, since we have been using the Coutard method for the treatment of tumors of the buccal cavity. During the series of irradiations, there develops in the patients, in absolutely every case, a considerable disturbance of the sense of taste, so that the patients, for about two weeks, are unable to distinguish between sweet and salted foods.

A disturbance of the sense of taste occurs when each half of the face has received about 1,000 r, whereas a sense of dryness arises after doses of 350 r for each half of the face. Since smaller doses are used for the treatment of chronic tonsillitis, a modification of the salivary glands and also changes in the sensory nerves of the buccal mucosa can always be avoided.

DISCUSSION

DR. KARL EISINGER: I take the liberty of asking Prof. Schwarz to tell us at this point something about the indications and the contra-indications of the method. It is quite possible that a patient who already has an appointment during the next few days for a tonsillectomy will ask us, if this mode of treatment becomes generally known, whether he is to be operated on or whether his case is of such a character that roentgen irradiation appears indicated.

DR. G. SCHWARZ (closing): I wish to endorse absolutely Menzel's statements, since at the time of which he speaks, which was before we had the potent, penetrating rays, the high-power energies, and the good filtration, we had to proceed very cautiously and hesitatingly, for which reason the treatment was unduly prolonged. It is quite comprehensible that the laryngologist at that time made use of the irradiation procedure only in rare cases. With reference to Eisinger's request to state the contra-indications (which I wanted to avoid, at the present time), I am now forced to speak, and will say at the start that Schönfeld and Baumbach, of the Leipzig Children's Clinic (Prof. Bessau), reject tonsillectomy in children absolutely, and approve, at the most, tonsillotomy; that is, clipping of the tonsils. They now accept irradiation as the procedure of choice. As contra-indications Schulte mentions: advanced age (above 50 years), severe infection of the tonsils when there is danger of spreading the infection, involvement of the adjacent lymphatic glands; also disturbances of the endocrine system and of the heart, nephritis, diabetes, exophthalmic

goiter, tuberculosis, asthma, hemophilia, or general physical weakness; furthermore, in speakers and singers, and, finally, recurrences after previous tonsillectomy.

THE SIGNIFICANCE OF THE MINUTE-r-AFFLUX FOR THE REACTION FROM IRRADIATIONS

DR. R. PAPE: We are familiar with a number of observations which prove that the effect of a roentgen irradiation of given dosage depends on the duration of the irradiation and the intensity of the rayage. Back in 1924, G. Schwarz observed distinct differences in the roentgen reaction on the skin, with changes in the intensity of the irradiation, which he represented by a relation of 1:4. On the other hand, a number of observations with a negative result have been reported, Borak's report having been one of the most recent. This apparent discrepancy may be explained by failure to consider the significance of the minute-r-afflux, which constitutes an expression of the absolute value of the rate of the irradiation. As these matters do not appear to be generally understood as yet, it may be well to cite four recent cases which show to how great an extent the skin tolerance, with a given dosage, depends on the intensity of the irradiation.

Conditions of the Experiment.—Two abdominal fields, 13 by 18 cm., 0.5 Zn + 1 Al, 180 kilovolts, 1.0 ma. (or 0.5 ma.), H.E.D. 35 (or 50) cm.; dosimeter, Mekapion. The left field received 2×700 r in 2×65 minutes interrupted by a 24-hour interval. That makes a total of 1,400 r in about two hours of irradiation, the minute-r-afflux 10.7 r. The right field received 2×700 r in 2×65 minutes, interrupted by a 24-hour interval, a total of 1,400 r in about six hours of irradiation, minute-r-afflux 4 r. The relation of the irradiation intensity was thus 1:3, or, more exactly 1:2.67. The patients for these and other experiments were secured from the gynecologic department of Prof. Latzko, who kindly placed an experiment room in his department at our disposal.

By the following description of results it can be demonstrated unequivocally that, in perfect agreement, the reaction of the *left* (that is to say, of the *rapidly irradiated field*) is *considerably more marked* than that of the *right, slowly irradiated field*. The difference does not become plainly discernible until after the main reaction (the fifth to the tenth week). The left field (10.7 r per minute) presented always a dense, brown, for the most part uneven pigmentation, erythema in patches, moderate scaling, subjective itching, while the right field (4 r per minute) presented a very delicate pigmentation, with only traces of an erythema.

By further experiments it was demonstrated that, with an irradiation intensity of 10 r per minute and the introduction of a 24-hour interval, the dosage can be increased, under the foregoing conditions, to 1,600 r.

SUMMARY

The skin reaction depends to a great extent on the minute-r-afflux. With a relation of the irradiation times, and thus of the intensities, the differences in the reactions are, indeed, considerable.

The tentative practical deductions from the experiments are: With an irradiation intensity of 10 r per minute, we can give 1,400 r in one day in two equal partial doses with an interval of from three to six hours, without endangering the skin. By introducing an interval of 24 hours, even 1,600 r are well borne. With a further reduction of the irradiation intensity to a minute-r-afflux of 4 r, a further increase of the dosage is possible.

DISCUSSION

DR. R. KIENBÖCK: In the last case, the dark border of the reactive pigmentation field is to be explained by the fact that here the electric discharges of the edge of the shield struck the skin, irritated and sensitized it and induced an hyperemia.

DR. J. BORAK: Dr. Pape evidently misunderstood me if he thinks that I deny absolutely the influence of the protraction of the irradiation period on the tolerance of the skin. In my analysis of the Coutard irradiation method, my observations led me merely to express the opinion that the fractioning of the dosage exerted a more marked influence on the accentuation of the tolerance of the skin than did the protraction of the irradiation. It has been found, namely, that it is possible to effect a remarkable accentuation of the dosage by merely fractioning it. Mischer and Chaoul reached identical results. To a certain extent, also, the experiments of Dr. Pape confirm that the mere protraction of the irradiation period influences the skin tolerance only to a very slight degree. For, while it is true that his experiments show a distinct difference in the skin reaction in the field irradiated three times as long, yet the difference is not three times as great. In other words, it appears to me that, from the practical point of view, it is not advisable to irradiate three times as long if only such a slight difference results. The difference consists mainly in the degree of pigmentation, whereas the duration of the reaction is the same. That with a relation of the irradiation periods of 1:3 a difference in the degree of reaction becomes evident is due solely to the fact that the partial doses employed by Dr. Pape were extremely high. That 700 r, with ordinary irradiation intensity, can be repeated on two successive days appears to be the most surprising result of Dr. Pape's experiments. Such high partial doses are not employed in connection with the Coutard irradiation methods. With a daily dose of only 200 r, when the irradiation is applied in accordance with the Coutard method, no difference can be observed with a total dose of 2,400 r, even when the relation of the irradiation intensities is 1:4.

DR. G. SCHWARZ: The measurements of Dr. Pape, carefully carried out, are especially important because they show that, even on the basis of 10 r minute-afflux and 4 r minute-afflux, changes in the tolerance dosage may be very distinctly observed in favor of the slow irradiation, as Dr. Pape very aptly has termed this mode of administration. By applying rays of weak intensity and by checking the r afflux, we get extremely close to the doses that have become known as tolerance doses for radium irradiation at a distance (so-called radium cannons). There is no doubt in my mind but that the new types of roentgen apparatus which are already completed but are not yet in general use and which are operated with 0.5 ma. and are attachable to any lighting system will dispense with the radium cannons. The mathematical fixation of the dosage with the various modes of operation (strong or weak intensity, slow or rapid irradiation) is important. It has been shown that the statement that so-and-so many r are employed has no precise meaning as regards the biologic reaction unless the minute-r-afflux—a term that we cannot get around—is added. The increase of dosage required for a slow afflux is exceedingly high. That with a slow afflux we must irradiate longer goes without saying; for example, in order to obtain 400 r with a 10 r minute-afflux we must irradiate 40 minutes, and with a 4 r minute-afflux, 100 minutes. But the 400 r with a 4 r minute-afflux do not produce the same biologic reaction as the 400 r with the 10 r minute-afflux. In order to secure the same biologic reaction, we must apply about 800 r, and thus irra-

diate not 100 but 200 minutes. This fact is not self-evident, nor is it sufficiently known. The determination of exact relations expressible in figures is the aim and content of the Pape researches.

DR. KRISER: The highly pigmented border on the medial and cranial side of the irradiated abdominal field is not, in my opinion, produced by electric charges, but is, I think, caused by other factors.

I have observed on inspection that, owing to the curvature of the abdomen, these sides of the field lie nearer to the tube focus than the caudal and lateral sides of the field. Owing to the lesser focal-skin distance, this side of the field up to the borderlines covered with a lead screen receives a correspondingly greater amount of rays than the side of the field that is more distant from the focus. Secondly, the lead screens absorb the whole mass of rays and give off only at the edges that border the field the hardest rayage in the form of secondary irradiation, which constitutes a dosage supplementary to the dose applied directly to the skin.

Thus the H.E.D. plus the lesser focal-skin distance, plus the secondary irradiation of the protective material, taken together, produce a greater linear effect, which is visible as a darker pigmented border.

DR. PAPE (closing): The deductions of Dr. Borak are based on a mathematically erroneous conception. He compares the effect of irradiation given in fractioned doses over a period of two weeks with the effect of a change in intensity of irradiation in the ratio of 1:3, and reaches the conclusion that the fractioned irradiation which is superior in this special case is superior by reason of the special principle involved. With equal right, however, one might assert the opposite: for example, I compare the effect of a change in irradiation intensity 1:100 or 1:1,000 with the effect of a simple division of the dosage into two parts and application with only a one-hour interval. Thus one would reach the conclusion that the change in intensity has more effect than the fractioning of the dosage. In judging the effect of fractioning the dosage, we must consider not only the total dosage but also the number of single doses and the intervals between them.

DEMONSTRATION OF A CASE OF ALBERS-SCHÖNBERG'S DISEASE

DR. WINDHOLZ: The patient was an 11-months-old child, who was referred to the Holzknecht Institute with a bilateral atrophy of the optic nerve. The child was the offspring of an incestuous connection. In addition to the high-grade atrophy of the optic nerve, there was a mild anemia, a square-shaped head, and a rigid thorax. The roentgenologic examination revealed a marked increase of the thickness and likewise the density of the bone-marrow spaces, whereas the substantia spongiosa was not recognizable. The metaphyses were swollen and knotted and dark transverse streaks passed through them. There was no disturbance of ossification and no fractures. Periosteal apposition *(sic)* streaks were visible on the inner surface of the tibia and the ulna. The Wassermann test was negative. There was a hereditary malformation of the skeleton. A simultaneous disturbance of the phosphorus metabolism was not to be excluded.

DISCUSSION

DR. R. KIENBÖCK: The disease in children was first described in detail by Laurell and Wallgren, in 1920, under the name "osteosclerosis infantilis generalisata fragilis." In the present case, strange to say, no fractures were observed.

DR. F. FLEISCHNER: The observation of periosteal apposition *(sic)* streaks, in his

case, which the speaker referred to as unusual in this disease, induces me to give a short report of an observation of my own. The patient was two years old, with generalized periosteal apposition *(sic)* streaks of several layers on nearly all the long bones, and a leukemic blood picture. We considered the case at the time as similar to a multiple periostitis, with myeloblast anemia, as reported by Jaksch. The case was published in the reports of the Wilhelminenspital. I should like to ask the speaker what relations, if any, there are between Albers-Schönberg disease and such rare disease symptoms, with generalized periosteal thickening of the bones. The speaker has called my attention to the fact that this publication is not by Feyrter but by his predecessor, Oesterlin, and is entitled "Ein Fall von kombinierter Knochen-Bluterkrankung" (*Arch. f. pathol. Anat. und Physiol.*, 1923, CCXLVII, 588).

DR. WINDHOLZ (closing): Albers-Schönberg disease has little in common with the symptomatic (reactive) osteoscleroses that appear in combination with leukemias, other than the morphologic behavior of the bones, which is in many respects similar. Albers-Schönberg disease appears for the most part in a familial form and is often congenital. It is characterized by a high degree of fragility of the bones: the anemias that accompany it are regarded as secondary manifestations. The aforementioned osteoscleroses develop after chronic leukemias, for the most part at an advanced age, and show no abnormal fragility of the bones. In a case that came to necropsy there was a chronic myeloid leukemia, with a large tumor of the spleen. The long bones were thickened and showed high-grade sclerosis; the marrow cavity and the substantia spongiosa were scarcely recognizable. In the case of Jaksch there was a periostitis without a diffuse osteosclerosis.

MEDICO-LEGAL DEPARTMENT

FEES

INSURANCE COMPANIES OR INDUSTRIAL COMMISSIONS HAVE NO JURISDICTION OVER MEDICAL FEES

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., CHICAGO

The question as to whether physicians or surgeons must accept such fees as are fixed in amount by industrial commissions or insurance companies has come up several times in discussions in the writer's presence and he has been asked about it by radiologists in Wisconsin, Indiana, Ohio, Pennsylvania, and Illinois.

In each of the replies to the eight radiologists who have asked this question he has replied, that, as far as he has been able to learn, the industrial commissions in the States named have no more right to fix medical, surgical, or radiological fees than they have to regulate the width of sidewalks or the weight of watermelons. In Illinois it has been decided in several cases which were appealed from the courts of original jurisdiction that "The Industrial Commission has no power as between the physician and his patient, to determine the amount of the fee to be charged for any medical service. In the absence of a contract between the physician and the patient regarding the amount of the fee, the physician may collect a fair and reasonable fee for his services, any finding, ruling, regulation, or decision by the Industrial Commission to the contrary notwithstanding."

In Noer *vs.* George Jones Lumber Co. (Wis.), 175 N.W.R. 784, 170 Wis. 418, the Wisconsin Supreme Court said: "The Workmen's Compensation Act deals exclusively with matters growing out of the relation between employer and employee. The provisions of that Act are binding upon employers and employees electing to be bound by them, and upon none others. All except employers and employees are strangers to the Act, and their usual lawful rights and remedies are unaffected by it."

In a case appealed to the Illinois Court of Appeals, the verdict of the lower court (in favor of a physician who sued for his fee) the defendant in the original trial claimed and contended that the Industrial Commission had the right to fix the amount of medical and surgical fees in industrial compensation cases. In rendering its decision in favor of the physician the Court said: "The question to be decided is whether it was the intention of the legislature, in the enactment of the provisions on which the defendant relies, to take away from the employer and a third person (in this case the physician) their right to contract with each other. Considering the whole Act in connection with these provisions, we think it is apparent that such was not the intention of the legislature. The theory upon which our Compensation Act is based is that the parties to whom it applies—the employer and his employees—must voluntarily elect to come under its provisions. It is when they have so elected that the Act deprives the courts of their jurisdiction to enforce contractual terms between them. The manner in which they shall come under the Act is the same by which physicians, if they elect, may voluntarily come under its provisions."

This consideration has been held to be controlling in the construction of similar statutes in other States.

In another Illinois Appellate Court case (Hoyt *vs.* London Guarantee and Accident Co. and Nokomis Coal Co., 227 Ill. App.

92), the court held that the Industrial Commission had no jurisdiction over the amount of Dr. Hoyt's fee, as the latter had not elected to come under the compensation law.

Still another decision is cited from the same court, in which an employer had engaged a Centralia physician to care for an injured employee and refused to pay the bill for same, claiming that the fixing of the amount of the fee should have been done by the Industrial Commission.

In this decision the Court said: "We find nothing in the Workmen's Compensation Act that makes it obligatory upon a physician who is retained by an employer to treat his injured employee, to submit his claim for such services to the Industrial Commission for its determination, nor is jurisdiction conferred upon said Commission to do so. In our opinion the court properly sustained the demurrer to the plea and the judgment should be affirmed."

In a case before the Indiana Court of Appeals—Sullivan *vs.* The National Car Coupler Co. (Ind.), 126 N.E.R. 494, 73 Ind. App. 442—almost identically the same decision as the last two was rendered.

Reasoning from the foregoing reviewed and decided cases, it would seem that we are fully justified in the statement that the industrial commissions or boards have no jurisdiction, and, in fact, nothing whatsoever to do with fixing the amount of the fees of physicians in industrial injuries or for services to patients of any sort or character, and we are not and cannot be made to be controlled or regulated as regards the amount of our fees in this or any other particular by these bodies.

CASES OF INTEREST TO RADIOLOGISTS

ROENTGEN INJURY AS EVIDENCE OF NEGLIGENCE IN A DIAGNOSTIC PROCEDURE

Ragin vs. Zimmerman (Calif.), 276 P.R. 107

A nurse employed by the defendant, Zimmerman, a dentist, tried to take a roentgenogram of the plaintiff's chin. The plaintiff was electrically shocked and burned in the process. From a judgment in his patient's favor, Zimmerman appealed to the Supreme Court of California. In his appeal, he assumed that the doctrine of *res ipsa loquitur* had been applied in reaching a verdict against him, and he combated the application of it to malpractice cases. The Supreme Court found nothing in the record to indicate that the trial court was influenced by that doctrine, but it did find that the cases cited by the defendant to show that the doctrine was not applicable in malpractice cases brought against physicians, surgeons, and dentists for errors in the treatment of disease had no application in the present case, because the appellant was not employing the roentgen rays for treatment when his patient was injured. While the Supreme Court found no reason for applying the doctrine to the present case, the Court would not hesitate, it said, to apply it to the facts described by the evidence if there were occasion for doing so. It quoted with approval Evans *vs.* Clapp (Mo. App.), 231 S.W.R. 179, as follows:

As hereinbefore stated, the X-ray was not applied in this case for purposes of treatment, but merely to ascertain the cause of plaintiff's headaches, and this was disclosed at the first examination. There is no room, therefore, for the application of a treatment intended to be applied in the accomplishment of a result similar to the one produced but not to the extent thereof. On the contrary, the X-ray was to be used only to discover a condition which was at once shown, and the many other exposures were not made in the interest of the patient,

but for other purposes. Examinations, when carefully and properly made, do not produce burns; hence when a burn is produced, this fact is of itself some evidence from which the jury may find that the degree of care and skill ordinarily exercised by persons of like profession and using such agencies was not exercised in that particuluar case. George *vs.* Shannon, 92 Kan. 801, 808, 142 P.R. 967, Ann. Cas. 1916B, 338; Shockley *vs.* Tucker, 127 Iowa 456, 103 N.W.R. 360.

The judgment of the trial court in favor of the injured patient was, therefore, affirmed.

FAILURE TO USE ROENTGEN RAYS IN REDUCING FRACTURE IS VERY COSTLY TO PHYSICIAN

Stoll vs. Balazs (Ohio), 167 N.E.R. 522

A kick by a horse fractured the tibia and fibula of the patient's left leg. Stoll, a physician, attempted to reduce the fracture, but at no time in the earlier stage of his employment did he use roentgen rays to guide him in diagnosis and treatment. According to the record, a ligament or tendon got between the ends of the broken bones and prevented union. When roentgen rays were finally used, they disclosed a space of from three-sixteenths to one-half inch between the ends of the bones. This, according to the record, resulted in an infection and sloughing off of bone, so that plates had to be used to bring the ends together to procure union. Ultimately there was a shortening of the leg. There was evidence to show that it was the customary and usual practice to use roentgen rays in the reduction of fractures, and, while they would not show a ligament or tendon between the ends of fractured bones, they would show that the bones had not been properly set so as to permit union. There was evidence to show, too, that the ultimate process of curing the infection and procuring union was exceedingly painful and that the patient's crippled condition was permanent. The jury returned a verdict in favor of the patient for $20,000. On appeal by the physician, however, the Court of Appeals of Ohio, Cuyahoga County, concluded that the verdict was excessive. The jury, said the Court, probably took into consideration the pain and suffering that the patient had to endure by reason of the horse's kick, which was no part and could be no part of a judgment rendered against the attending physician, because he was in no way responsible for it. Nevertheless there was ample evidence to justify a verdict against the physician. It was ordered, therefore, that the judgment of the court below be reversed unless the patient remitted $5,000 of the verdict and accepted $15,000 in settlement.

RES IPSA LOQUITUR IS MADE TO APPLY IN ROENTGEN DERMATITIS

Lewis vs. Casenburg (Tenn.), 7 S.W.R. (2d) 808.

"The area to be exposed (treated) ought always to be examined before exposure is given."

The defendant, Casenburg, administered 161 roentgen-ray treatments to a Mrs. Lewis, extending over a period of six years. After the last treatment a third degree dermatitis appeared on her abdomen, covering a space of 7 by 9 inches and sloughing off "practically to the lining of the intestine." Mrs. Lewis died, but whether from the effects of the injury or from some other cause the record does not show. Her administrator sued to recover damages for the injury done by the burn. The trial court directed a verdict for the defendant. The Court of Appeals, however, reversed the judgment of the trial court and remanded the case for a new trial. Thereupon the defendant petitioned the Supreme Court of Tennessee for a writ of *certiorari* in order to obtain a review of the case by the court. Practically all of the experts testified that idiosyncrasy

usually manifests itself after the first treatment and occasionally after the second, but none of them had ever seen a case after the third treatment. The Supreme Court, therefore, concurred in the opinion of the Court of Appeals that the burn in this case could not have resulted from an idiosyncrasy.

There was evidence to show that the defendant did not uncover and examine the area to be treated on the occasion when the burn was inflicted. Concerning this, one of the expert witnesses said: "Just because a patient has stood a certain amount of roentgen-ray therapy on previous occasions is no criterion by which the doctor can be guided as to future treatments. . . . The area to be exposed ought always to be examined before exposure is given."

The occurrence of a roentgen-ray burn, even after 160 treatments had been safely given, would indicate, this witness testified, "that before the last exposure was given there was a definite indication upon the surface of the skin which even to the semi-trained eye would indicate that he was treading on dangerous ground, or second, that there was some mistake of the technic or some error of judgment in giving the amount of the exposure that was given at that time, which was sufficient in itself to cause a roentgen-ray burn of the severity as described."

The Supreme Court concurred in the opinion of the Court of Appeals that under the doctrine of *res ipsa loquitur* there was sufficient evidence to take this case to the jury. The Supreme Court quoted 20 R.C.L. 187:

> More precisely, the doctrine *res ipsa loquitur* asserts that, whenever a thing which produced an injury is shown to have been under the control and management of the defendant, and the occurrence is such as in the ordinary course of events does not happen if due care has been exercised, the fact of injury itself will be deemed to afford sufficient evidence to support a recovery, in the absence of any explanation by the defendant tending to show that the injury was not due to his want of care.

The reason generally assigned for rejecting the doctrine of *res ipsa loquitur* in a case such as that before the court is that it does not take into account the idiosyncrasy of the patient, which is occasionally responsible for the burn. In this case the conclusion seemed inevitable that the burn could not have resulted from an idiosyncrasy. *Res ipsa loquitur* means merely that the facts warrant the inference of negligence, not that they compel such an inference. They furnish circumstantial evidence of negligence where direct evidence may be lacking, but such circumstantial evidence is to be weighed, not necessarily to be accepted as sufficient. It calls for explanation or rebuttal but does not necessarily require it. It makes a case to be decided by the jury but does not forestall the verdict. When all the evidence is in, it is for the jury to determine whether the preponderance is with the plaintiff.

The action of the Court of Appeals in reversing and remanding the case for a new trial was correct, and the petition for the defendant for a writ of *certiorari* was therefore denied.

LIMITATION BEGINS TO RUN WHEN TREATMENT CEASES

Schmitt vs. Esser (Minn.), 226 N.W.R. 196

In malpractice cases there is difficulty in determining the precise moment when the act or omission which caused the damage took place. The neglectful or unskillful act may occur at some particular moment during months of attendance on the patient, or it may persist and characterize the whole treatment. It would seem advisable, therefore, not to apply the bar of the statute of limitations unless it clearly appears from the complaint that the unskillful or negligent act which caused the injury antedated the action by a period greater than the statutory pe-

riod of limitations. "We think," said the Supreme Court of Minnesota, "that the treatment and employment of a physician should be considered as a whole and that, in event of malpractice, the statute of limitations begins to run when treatment ceases."

DEATH FROM ROENTGEN INJURIES

Hess vs. Rouse (Texas), 22 S.W.R. (2d) 1077

The defendant, Hess, a physician, administered three roentgen treatments. The first was applied to his patient's abdomen. A few days later a treatment was applied to her back, followed in a few days by the third treatment, also to her back. In a short time, apparently after the last treatment, a third degree dermatitis developed covering an area of about 4 by 7 inches. The tissues under the burned area sloughed off "down to the lining of her intestines," and the patient died. Her husband and children brought suit. Judgment was rendered against the defendant for $8,467.50. He appealed to the Court of Civil Appeals of Texas (Austin), where the judgment was affirmed.

Physicians testified that a third degree burn is ordinarily the result of (1) administering roentgen rays of too great strength; (2) not focusing at the proper distance; (3) continuing the treatment for too long a time; (4) using the roentgen-ray machine without a proper filter, or, at all events, a failure of the physician to observe some established method or rule of administering roentgen therapy. Testimony was offered to show that occasionally a patient possesses an idiosyncrasy or supersensitiveness with respect to roentgen rays and is more liable to be burned than is the ordinary patient. The existence of an idiosyncrasy in the present case, however, said the Court of Civil Appeals, was fairly negatived through testimony showing that when an idiosyncrasy exists it extends alike to all parts of the body and is ordinarily detected in the first or second treatment. The deceased was burned from one of the treatments, but not from the other two. The evidence was sufficient, said the Court, to warrant the jury in finding that the defendant failed to use the reasonable degree of care, skill, and diligence in treating the deceased with roentgen rays that is ordinarily used by the average members of the medical profession in good standing in the community where the injury occurred, under the same or similar circumstances, and to warrant it in concluding that such failure was the direct and proximate cause of death. This, said the Appellate Court, is the test of liability in a case of this character.

The defendant moved for a new trial, alleging that he had discovered after the trial that another physician had applied "Iodex" and "Antiphlogistine" to the burn on the body of the deceased, applications contra-indicated in roentgen burns and which, if used to any great extent, cause a breaking down of the tissues and lead to the death of the patient. The defendant, himself, however, treated the deceased until her death. Certainly, said the Court, he should have detected any improper treatment by other physicians, who occasionally treated the deceased in his absence. The plaintiffs, when they started this suit, admitted that they had employed other physicians to treat the burn, and common reason should have suggested to the defendant that it was important for him to ascertain what medicine had been used by them. The evidence shows simply that the defendant did not exercise any degree of diligence to obtain such information. As one essential to granting a new trial on the ground of newly discovered evidence is that the party asking for a new trial could not have obtained such evidence by a reasonable degree of diligence before the trial, the trial court did not err in overruling the defendant's motion.

INTERPRETATION OF ROENTGENOGRAMS

Appleby vs. Cass (Iowa), 229 N.W.R. 210

Appleby's right temple was injured in a collision between an automobile driven by him and an automobile owned by Cass. He sued Cass. In the course of the trial, one of Appleby's physicians undertook to explain to the jury the significance of various features of a roentgenogram itself offered in evidence. Counsel for Cass objected, asserting that this was not proper testimony and that the roentgenogram itself was the best evidence of what it showed. The objection was overruled. The jury rendered a verdict in favor of Appleby, and Cass appealed to the Supreme Court of Iowa.

In Elzig *vs.* Bales, 135 Iowa 209, 112 N.W.R. 540, the Supreme Court of Iowa held that a photograph was itself the best evidence of what appeared in it, and in Lang *vs.* Marshalltown L. P. & R. Co., 185 Iowa 940, 170 N.W.R. 463, it applied the same rule to a roentgenogram offered in evidence to show a curvature of the spine, the question being only whether it showed a straight line or a curved one. In the latter case the roentgenogram served a purpose similar to that of a photograph. In Daniels *vs.* Iowa City, 191 Iowa 811, 183 N.W.R. 415, 416, however, the Court opened the door to expert evidence offered for the interpretation of a roentgenogram, saying:

> It is proper for an expert to explain an X-ray photograph in such particulars that are not understood by a layman. (See State *vs.* Matheson, 142 Iowa 414, 120 N.W.R. 1036, 134 Am. St. Rep. 426.) What the jury could see and understand about the matter is not the subject of expert testimony, and this we understand to be the effect of our prior decisions. A radiograph may be used for purposes of demonstration by an expert as though he had the object itself before the jury for explanation (Sheldon *vs.* Wright, 80 Vt. 298, 67 A.P. 807).

The Supreme Court might properly, it said, take judicial notice of what is well known to the profession, namely, that a roentgenogram does not necessarily or ordinarily interpret itself to the observation of a non-expert. A roentgenogram carries various lights and shadows the significance of which is known to the expert and is not known to the non-expert. In the present case the purpose of the roentgenogram was to show the existence and location of a "perforation of the temple." The physician in the case had diagnosed "hole" in the temple. This "hole" was indicated by the experts by certain characteristics of light and shadow in the roentgenogram. It was not observable as a "hole" on the ordinary scrutiny of a non-expert. The purpose of the expert testimony was to explain the meaning of the lights and shadows in the roentgenogram. Such an explanation was essential to a proper understanding of it and the admission of expert testimony for that purpose was proper. Only when a roentgenogram is offered in evidence to serve nothing more than the function of a photograph is it subject to the rules of evidence applying to photographs.

The judgment of the trial court was reversed, however, on grounds not pertinent to the subject matter of this abstract.

COLLECTION OF PHYSICIAN'S FEES FOR SERVICES TO INJURED WORKMEN

Wilson Drilling Co. vs. Beyer (Okla.), 280 P.R. 846

The Workmen's Compensation Act of Oklahoma, says the Supreme Court of Oklahoma, is not concerned with claims against employers, except such as are incident to pending claims of workmen or their dependents, for compensation based on injuries to workmen. Medical services are covered by the Act only as they are ancillary to its prime purpose, relief for the injured employee. *A physician treating an injured*

employee may resort to the courts for the collection of his claim either against the employer who authorized his services or against the employee to whom they were rendered. The Industrial Commission cannot hear and determine a physician's claim for payment for professional services to an injured employee, unless the employee has filed with the Commission his claim for compensation.

In the present case the appellee, Beyer, filed with the Industrial Commission more than two years after the injury an attending physician's report showing that he removed a piece of steel from the right eye of an injured employee of the appellant. The injured employee filed no claim for compensation and no award was made to him. The Industrial Commission, however, awarded his attending physician, Beyer, $100 for his professional services. The employer thereupon appealed to the Supreme Court of Oklahoma.

The question presented, said the Supreme Court, is whether proceedings to recover payment for professional services in treating an injured employee can be instituted by a physician independent of proceedings by the employee to recover compensation for the injury or are necessarily supplementary to proceedings instituted by the injured employee; in other words, can the claim of the physician, standing alone, be heard and determined by the Industrial Commission, or is it necessarily relegated to the courts of law? The Supreme Court quoted Robinson *vs.* Taylor, 116 Okla. 131, 244 P. 44, 47, in which an award had been made for the benefit of a physician and a hospital, ancillary to the main case, and in which the Court said:

It was further contended that the Commission was without power to make an award direct to the doctor and the hospital. The contention is correct, and if, independent of the main case, the doctor had presented his claim or the hospital had presented its claim, we should say that the Commission had no jurisdiction.

In Scruggs Bros. & Bill Garage *vs.* Commission, 94 Okla. 187, 221 P.R. 470, 475, question arose as to the right of the Commission to make an award direct to the physicians who had treated an injured employee. The injured employee, who was claiming compensation on his own account, had not paid the physicians for their services and a claim for payment for medical services was therefore filed independently of his claim. In that case it was held that it was not improper nor beyond the authority of the Industrial Commission to award both claims to the injured employee, but the Commission should have declared a lien on the amount awarded the injured workman, in favor of the physician-claimants, for the amount found to be due them. The Court said:

We think the Commission was in error in making this supplemental order for two reasons, the first being that claims arising under the workmen's compensation law are matters strictly arising between the injured employee on the one side, and the employer and his insurance carrier on the other. Differences between the employer and his insurance carrier and third persons are not cognizable before the Industrial Commission.

In Associated Employers' Reciprocal *vs.* Commission, 87 Okla. R. 16, 208 P.R. 798, 801, the Court said:

But where the employer voluntarily furnishes medical services, it is a matter of contract solely between the employer and the physician, and the Industrial Commission has no jurisdiction of such matter. But where controversy arises, the parties are relegated to the courts for an adjudication of the matter.

In Bloom *vs.* Jaffe, 94 Misc. Rep. 222, 157 N. Y. Supp. 926, 927, it was held:

The primary purpose of the statute is not, however, to provide compensation to physician, but solely to provide compensation to the injured employee for such medical service as the law permits him to procure at the expense of his employer. It does not, therefore, provide for any award to a physician, but merely gives the physician a lien upon the compensation awarded to the workman, which "shall be paid therefrom only in the manner fixed by the Commission."

Because the claim filed by the physician in the present case could not be considered by the Industrial Commission in the absence of a claim for compensation filed by the injured workman, and because the injured workman had not filed such a claim within the time limited by law, one year after the injury, the Supreme Court reversed the order of the Industrial Commission awarding the physician compensation for his services and directed the Commission to dismiss his claim.

WORKMEN'S COMPENSATION ACTS: "ACCIDENT" DEFINED

Carr vs. Murch Bros. Const. Co. (Mo.), 21 S.W.R. (2d) 897

An unexpected and unforeseen result of a usual and intentional act or movement done in the ordinary course of employment is an accident within the meaning of Paragraph *(b)* of Section 7 of the Missouri Workmen's Compensation Act, which defines "accident" as meaning "an unexpected or unforeseen event happening suddenly and violently, with or without human fault and producing at the time objective symptoms of any injury."

The strangulation of an old hernia, that resulted from reaching up in the ordinary course of employment to manipulate a steam valve, is an accident within the meaning of the law, and the injured employee is entitled to compensation, according to the Missouri Supreme Court.

EDITORIAL

WHITHER THE RADIOLOGIST?[1]

During my perusal of the periodicals devoted in whole or in part to radiology, I have been impressed in recent weeks by the frequent appearance of articles and editorials dealing, not with the scientific side, but, let us say, with the sociologic and economic phases of our specialty. Since these same phases have been a great deal upon my own mind, I resolved that I would make an effort to focus a discussion on this subject.

Many of the leaders in our science have expressed their concern, in print and otherwise, over the status of our specialty, and I was interested to see, in the minutes of the last meeting of the American College of Radiology, the record of an extended discussion of this subject.

There must be some reason for this matter coming up in the minds of so many of us who are so widely separated over the country. It must mean that many of us feel that there is something in our ménage that needs adjustment; that there are some common evils in our profession that are general, no matter in what location we are practising.

These articles have dealt generally with the status of the radiologist, both in hospital and private practice, his relation to the other branches of medical practice, and the general trend of the estimation of his work by these other branches. The question has been asked, "Is radiology moving toward complete recognition as one of the most highly specialized branches of medicine and surgery, or is it being hampered in its progress by certain conditions and influences which have been ignored or disregarded too long?"

No apology is necessary for the introduction of this topic into a session otherwise devoted to purely scientific deliberations. It will do us no harm to glance up occasionally from our absorbing scientific investigations to take a view of the horizon and the stars, get our bearings, so to speak; then we can return to our browsings for a while longer.

We assume with assurance that our specialty is an honorable one, one eminently worth while; that it deals with a most fruitful source of information in the *diagnosis* of disease, and with one of the most potent of all principles in the *therapy* of disease; that it touches intimately every other branch of medical practice, from the standpoint of both diagnosis and therapeutics.

Radiology is a relatively young science, and for that reason it may display many of the frailties of youth, but I dare say also that radiology displays much of youth's vigor, enthusiasm, and vision. Those of us who have dedicated our lives to this young science would like to feel that we are doing our best in every way to further its progress and to enhance its usefulness. Many of our number are performing wonderful service in making this youth grow to a strong lusty man physically; that is, rapid strides are being made in the *science* of radiology. New and valuable diagnostic methods, perfected

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1–5, 1930.

apparatus, and increased accuracy and efficiency of therapeutic dosage, all are the fruits of painstaking research. But in all this enthusiasm in building a fine healthy youth, I fear we have been remiss in teaching him some of his manners, so that he may appear in respectable society without embarrassment to his elders. I believe you apprehend my meaning: that it is most necessary that this young specialty be made to occupy the dignified relation to the general medical profession and public which its importance warrants.

Let us look briefly over the life of this growing youth from the beginning up to the present, review some of the important influences that have had an unfavorable effect upon his life, analyze them briefly, and finally try to offer some suggestions for improving this situation, with the object that this specialty may deservedly occupy a more dignified position than it appears to have occupied up to the present moment.

One of the most important unfriendly factors that we have to face is the attitude of our medical practice laws. Beauty parlors, shoe stores, laymen, chiropractors, and all sorts of parasitic growths that have attached themselves to the medical body, are allowed to use the roentgen ray at will and without hindrance. The implication is obvious, that the practice of radiology is not the practice of medicine. What a great injustice, that a medical law may say that a person not duly qualified may not legally prescribe a dose of quinine, which, if you give too much, causes only an unpleasant ringing in the ears, but that anybody, qualified or not, may administer a dose of the roentgen ray, which, if too large, may do irreparable harm.

It is hard sometimes to understand why medical laws appear in so many instances to have an unfriendly attitude toward that great body of the medical profession, which is doing so much for the relief of the suffering of mankind. Perhaps this is not difficult to understand when one has had occasion to meet certain units of the legislative bodies that are making the laws, that are manifestly swayed either by the weight of their own ignorance or by a prejudice cultivated in them by some of the groups of medical parasites whose mental mechanism, being more nearly of the same caliber as their own, impresses and influences them more easily.

Several years ago two prominent radiologists of San Francisco and I made a pilgrimage to our State capitol to remonstrate with a certain committee that was contemplating a law to license lay radiographers. It certainly was far from an exhilarating and encouraging experience to find the laws governing the practice of a learned profession being manipulated by men who had positively no conception of the principles with which they were dealing, and who were obviously laboring under the pressure of forces quite inimical to the medical profession. By some unaccountable mistake, a legislator who was a member of our own profession was on that committee, and he proved our only salvation in this case.

What can we do about this? Medical laws, particularly as they affect the radiologic profession, must eventually be changed. This Society has its Legislative Committee which has been active. It deserves our whole-hearted co-operation.

I sometimes wonder, however, if the medical profession may not have participated too deeply in legislation at times, and may not have come out of it without much gain.

It has at times seemed necessary to organize certain bodies with the express purpose of taking an active part in politics insofar as they touch on medical legislation. These organizations have done some good work, but I can never forget the time when a large and prominent state medical society was on

the point of organizing the lay technicians of the State into a society, to be associated with itself, the movement being largely fostered by a political organization allied with the state medical society. This plan did not succeed, due to the active efforts of some very wide-awake radiologists in that society. It is only fair to say that this was several years ago and probably would not happen now.

While I repeat most emphatically that our present medical laws are unjust in respect to the radiologic profession and must be eventually changed, I am not advocating active campaigns for the change of these laws at the present time, because I believe there are conditions closer at home which should be remedied first.

I believe we have also been done an injury, unintentionally, no doubt, by the efforts of assiduous salesmen of X-ray apparatus. Urged by pressure from the sales manager and the very pardonable desire for commissions and advancement, they have canvassed the entire medical profession, both regular and quack, and succeeded to no small degree in persuading a goodly proportion of the profession that the ownership of X-ray apparatus, plus a few instructions from the salesman as to the location of certain switches and buttons, constitutes them full-fledged radiologists. These salesmen have appealed to the very natural desire for financial gain by painting glowing pictures of the marvelous prosperity of those engaged in radiology *(sic!)*, and have loaded some of them with an array of apparatus and accessories that would bewilder many an experienced worker.

Hear this excerpt from the advertisement in a leading surgical journal, of one of our large manufacturers of X-ray apparatus: "Apparatus so perfected that its safe and satisfactory operation requires no specialized training." Further in the same advertisement we read, "Make your own X-ray examination!"—and then, almost sensing a recoil from some irritated radiologist, there follows, "Consult your roentgenologist in doubtful cases."

It is the experience of most of us, I am sure, that the ordinary practitioner is not aware of the confines of that borderline of doubt—doubt which often first appears to enter his mind when a patient of upwards of two hundred pounds confronts him, and he wonders if he can do the case justice with his particular machine. Needless to say, none of these suggestions appears in any of the advertisements in the radiologic journals.

Seldom are these salesmen found to advise prospective customers, in the words of the familiar automobile advertisement, "Ask the man who owns one." Too often that man would tell the physician this scheme is a snare and a delusion, that he has a white elephant on his hands that will not pay for its keep; and while he is wasting time and materials trying to get some sort of image on a film, to say nothing of learning what it means, he could advise with several patients along lines in which he is better qualified, with greater profit to the patient and to himself.

It is obvious we can do nothing about this situation. The manufacturer is bent on establishing a larger volume of business—no matter where his product goes. If this volume should result in diminished cost of apparatus, we might all benefit by it, but so far this has not happened to any noticeable degree. In full justice to our medical confrères who live within easy reach of a competent radiologist, it is only fair for the radiologist to speak frankly when his advice is asked concerning the purchase of X-ray equipment. The physician should be reminded of the great expense attached to the use of X-ray apparatus, the increased hazards, the greatly increased insurance premiums, and the necessity of conscientiously giving a large amount of time to learning the techni-

cal and professional sides of the work. Better no X-ray service at all than one used in the casual manner prevalent in many general practitioners' offices.

In my early years of general practice I remember well hearing a prominent diagnostician, for whom I had great admiration, say that he made all his own observations of the eye grounds, whereupon I immediately purchased for myself an ophthalmoscope. After trying for a while to use it, I laid it aside and never used it again, preferring to have the ophthalmologist do that work for me, and deciding that either I was very stupid, or my internist friend was not so smart as he thought he was.

However, our attitude toward the general practitioner who is trying to do some X-ray work should be one of friendly sympathy and helpfulness. Nothing is to be gained by a spirit of resentfulness to the invasion of our special field. The physician should be encouraged to bring his films to us for examination and advice. Nothing will convince him sooner of the fallacy of the idea that the practice of radiology is a simple affair, to be mastered after a few days of instruction from a salesman.

The disposal of the films taken in the course of roentgen-ray examination is also open to discussion. The value of the film itself is too often unduly stressed. It is my opinion that the X-ray films are for the use of the profession only, and that the placing of the films in the hands of patients or friends, following an examination, only tends to encourage the idea that it is films they pay for instead of a medical opinion. This practice exposes the patient further to the injustice of having these films interpreted by unqualified persons, and in some instances to being led to unnecessary and even dangerous treatment.

The compensation insurance companies are offenders in basing their compensation to the radiologist on the number and size of films taken. I will confess that it ruffles me not a little every time I am required to stipulate these figures, as though we could deal out roentgen diagnosis by the square inch. I realize the obvious fact that frequently a vastly more important diagnosis, both to the patient and to the insurance company, is made from the evidence on a small 5×7 film than in another case on several 14×17 films.

Such conditions as these tend to put the roentgen laboratory on the basis of a photograph gallery. Some time ago this fact was brought very forcibly to my mind, when the operator in a prominent local photograph studio was referred to me for X-ray examination. When he appeared for the work, he began by asking me in all seriousness if there would be a professional discount.

The most serious blot on the name of the science of radiology is the lay laboratory, and its attendant ills. It is largely the outgrowth of the laxness of our medical laws, combined with the short-sighted, selfish attitude of a certain proportion of the medical profession.

The X-ray laboratory, run solely by lay hands and catering to the undiscerning of the medical profession, is an almost unmixed evil. No less so is the laboratory to which a graduate in medicine, forgetting the high ideals of his profession, has lent his name, in order to give it a semblance of respectability, but in which he takes no directing part whatsoever.

Most pernicious and disgraceful is the laboratory, whether lay, professional, so-called "co-operative," or what you will, that participates in that subtle form of fee-splitting known as the rebate. It is a peculiar mental quirk that will permit a physician in good and honorable standing in his local and national medical associations to hold up his hands in holy horror at the suggestion of splitting a fee with another physician, yet

will allow him with marvelous complaisance to accept a check each month as a *pro rata* of the work he has sent to an X-ray laboratory. How can these physicians themselves have any respect for a branch of medical work which indulges in such practices, even though they are receiving gratuities from them?

This disgrace will be abated only when our medical laws are improved, and when the radiologic profession, by its own improved practices, which I shall mention later in the paper, has shown that it can lift the specialty to a higher plane.

Closely allied to this subject is the one which deals with our relation to the radiologic technician. There is none of us but will gladly admit the great dependence we place on an efficient technical assistant. With the increasing facilities for detail work, and the resultant widening usefulness of radiologic diagnosis, the demand for expert technical service is daily becoming greater.

To-day the increasing importance of the highly trained technical assistant in busy radiologic departments may cause undue stress to be laid on this purely technical phase of the work, and, too, we are prone to let patients pass through our offices or departments, seeing only the technical assistants and the bookkeeper, never having a single contact with the professional side of the organization. Little wonder, then, that the public comes to view the layman's services as constituting the entire performance; nor is it entirely unnatural that the assistants, particularly the male ones, may at times, without intention, begin to assume an importance which threatens to be somewhat top-heavy, to say the least.

I was impressed with this fact, and not a little shocked, very recently to read in one of our leading radiologic journals an advertisement which was worded, *"Associate wanted.* [Mind you!] Experienced technician desires to associate with physician interested in X-ray and light therapy. Must be young, progressive, and open-minded."

It reminded me of some recent interviews with prospective domestic help. Before I had a chance to ascertain if they could cook well enough for me to employ them, they were investigating my qualifications as an employer.

Our own history of development may have a certain bearing on this situation. It is a fact that some of our most cherished names in radiologic history are those of men who in their early years were not medical graduates. Such men as the beloved Caldwell and Walter Dodd, as well as some living and active to-day, began as laymen. But all the more significant is the fact that they eventually realized that, without a medical education, even they were not giving a service worthy of its dignity to their chosen work.

The production of a technically beautiful roentgen film of a difficult portion of the body is a work of skill and of art. It is an honor to the man or woman who produces it, and deserving of all praise, often more than it receives. However, just as those illustrious pioneers in radiology who started as laymen found that their usefulness had very distinct limits until they had rounded out their medical education, just so does the lay radiographer of to-day meet a very sharply marked boundary at the point at which his function ends and that of the professional service of the roentgenologist begins. Fortunate is that technician who realizes this fact and complies with its exactions, for he has in store for him years of happy association with the medical profession with the enjoyment of mutual confidence and appreciation. He can gain nothing but distrust and disturbed and unhappy relations by any other attitude.

This Society has done a distinct service in the fostering of the Registry of Radiological Technicians, an organization that has a code of conduct which, if adhered to, will

go far toward maintaining the attitude of the roentgenologist and technician toward each other as a happy one.

Admitting the importance of all these external influences, there is to my mind a problem much nearer home which demands solution, the close and conscientious attention to which will go further than any one thing toward enhancing the value of the radiologist in his medical community, and bringing him to that position of recognition which the importance of his specialty deserves. Our great fault, I believe, is the position so many of us have assumed of isolating ourselves from the clinical practice of medicine. We have burned up the roads between various branch offices and hospitals on film-reading expeditions. We have seen little of our patients, except when fluoroscopy was needed, and have neglected even then to take a personal interest in the clinical side of the case. We have failed to discuss cases fully, as we should have done, with the referring physician. We have not acquainted ourselves with his problems in the particular case in which he is seeking our help. How can we expect him to consider us as consultants if we do not even see his patient, or ask for the history and clinical and other laboratory data?

Most emphatically do I assert that until we institute a very distinct reform in this practice radiology will never be considered much more than a mere incidental influence in the diagnosis and treatment of disease. Unless we renew within ourselves the realization that we are practising medicine, first, last, and all the time, we can never expect the profession or the public to recognize us as standing shoulder to shoulder in the front rank with the specializing internist, surgeon, laryngologist, and the other specialties.

In a recent issue of RADIOLOGY one of our members wrote a very fitting tribute to a confrère who had died in an Eastern city. Most pointed was the remark, "He was a physician practising radiology." How aptly put! What a stinging rebuke to those of us who have fallen so far short of the full measure of our usefulness, and whose knowledge of the patient entrusted to us is too often confined to a few square inches of celluloid.

In the progress of our specialty toward maturity we shall find that more frequently the patients are seeking the services of the radiologist first hand. I am sure most of us are experiencing this already. Heretofore we have had all but a very small portion of our work referred by other physicians, and we have been largely depending on the patronage of a profession which is notoriously whimsical. (It is permissible to say this since we include ourselves with the rest.)

I believe that the opinion expressed by Dr. Groover in a recent editorial is correct. We shall find with increasing frequency that patients will seek radiologic advice and service on their own initiative or will suggest it to their attending physicians. It will consequently follow that the radiologist will himself become a referring physician. He will be directing patients to other specialists for certain services. His stock will rise noticeably then. It only remains necessary that the radiologist keep himself *clinically alive,* and maintain his touch with the progress of medicine in other lines. With strict adherence to the ethical principles, with which we are all conversant, he can pursue this course with perfect justice to his referring clientèle, and grow in respect and usefulness. He must prepare himself to discuss intelligently, in staff and medical society meetings, all cases that he has contacted or that concern his work, and by "intelligently" I mean with the ability to realize the clinical significance of the case. It is his duty, with becoming modesty, to keep his fellow-practitioners informed of advances in his own line, being careful to avoid a controversial attitude, as though there were some competitive element in the various treatments or methods of diagnosis.

I think we have drawn a little fire of antagonism from certain quarters by an attitude, which we are sure is well founded, on such subjects as the therapy of toxic goiter and certain malignancies. We should be careful in this matter.

Let no one think, who may read this paper, that I am in any way complaining of monetary loss caused by these unfriendly influences. I believe there will always be enough for the qualified radiologist to do so that he will be provided with a decent living. My arguments are purely from the standpoint of the dignity of our profession, for, after all, our richest pay is the joy of service—through a medium in which we can justly take pride.

All in all, the specialty of radiology appears to me to have a most alluring future in its ability to serve the sick, both directly and through pleasant contacts with the profession. This will be chiefly, not through worrying about medical laws or the numerous pestilences that harass us in the form of quackery and dishonesty, but through the broadening of our medical lives into the full scope of usefulness they should possess, that is, by being "physicians practising radiology."

CHARLES M. RICHARDS, M.D.

COMMUNICATIONS

RESOLUTION

At the Annual Meeting of the Society, held in St. Louis, Nov. 30–Dec. 4, 1932, the following Resolution was adopted:

Resolved, That the Executive Committee of the Radiological Society of North America is authorized and is hereby specifically instructed to employ accountants and clerical help and to take any measures which, in its judgment, are necessary or desirable to put the financial affairs of the Society on a sound business basis, and to enable this Committee to render complete and exact financial statements of the cost of the Society to its members, and of the cost of its Journal to the Chemical Foundation, and to make any further agreement with the Chemical Foundation which, in the best judgment of the members of the Committee, are proper and will tend to enlist its further support.

The adjustment covered by this Resolution is still going forward, necessitating much labor by members of the Executive Committee and especially our President, Francis Carter Wood, M.D., and our Secretary-Treasurer, Donald S. Childs, M.D. It is hoped that their efforts may result in arrangements whereby the Journal may continue to be a source of satisfaction to its readers.

DISCONTINUANCE OF JOINT SUBSCRIPTION

It has been decided to discontinue the joint subscription rate for *The American Journal of Cancer* and RADIOLOGY, as announced in RADIOLOGY, December, 1930, XV, 700. The subscription rate of *The American Journal of Cancer* is $5.00 in the United States, $5.50 in all other countries. The subscription rate of RADIOLOGY is $6.00 in the United States, Canadian and foreign postage $1.00 additional.

It is hoped that all physicians interested in radiology are already or will become subscribers to both journals.

SUB-COMMITTEE ON RADIOLOGY

Dr. Leopold Jaches, of New York, has been appointed a member of the Sub-committee on Radiology to the International Hospital Association for the study of the care of the patients in hospitals. This honor was conferred upon him by Dr. Hans Holfelder. The principal questions to be considered are the following:

1. Specialization of the entire field of roentgen diagnosis and radium therapy; its establishment as an independent specialty and its right to independent quarters in the hospital.
2. Centralization or de-centralization.
3. Does the radiological division require its own bed units?
4. Arrangement and disposition of space and technical adjustment.
5. Scope and limitations of radium therapy in the hospital and conditions of its application.

Dr. Jaches is to represent the member from the United States. There are twelve countries in all, each sending one representative.

AN APPRECIATION

Under the assistant-editorship of S. W. Donaldson, M.D., of Ann Arbor, Michigan, *The Journal of Phi Rho Sigma* has issued a Roentgenological Number (January, 1932). It contains papers by B. R. Kirklin, M.D. ("Graduate Training in Roentgenology"), L. R. Sante, M.D. ("The Economic Phase of Radiological Practice"), James D. Bruce, M.D. ("Post-graduate Teaching of Roentgenology"), Clyde K. Hasley, M.D. ("X-ray Therapy"), and S. W. Donaldson, M.D. ("Choosing Roentgenology as a Specialty"). There are splendid editorial comments by Albert Soiland, M.D., Jonathan Forman, M.D., Walter M. Simpson, M.D., Norman MacNeill, M.D., and S. W. Donaldson, M.D. The *Journal* has a circulation of some 6,000 among medical men and, besides the articles enumerated, contains much material of interest to members of Phi Rho Sigma and Chi Zeta Chi. The editors are to be congratulated upon a publication of real value.

RADIOLOGICAL SECTION OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION

At a meeting of the Radiological Section of the Los Angeles County Medical Association, held December 16, 1931, the following officers were elected for 1932: *President,* W. E. Costolow, M.D.; *Vice-president,* Karl Bonoff, M.D.; *Secretary,* D. R. MacColl, M.D.; *Councillor,* Kenneth Davis, M.D.; *Treasurer,* Henry Snure, M.D.

DEATH OF MR. WILLIAM H. DODGE

It is with regret that we have learned of the death of Mr. Dodge, on February 1. He has been known to many roentgenologists throughout the country as one of the best X-ray technicians, who took pride in producing fine roentgenograms and in teaching others to do the same. He numbered among his friends leading radiologists and apparatus builders, who had respect for Mr. Dodge's ability and maintenance of high standards in his chosen field.

THE RADIOLOGICAL REVIEW RADIUM NUMBER

The March, 1932, issue of *The Radiological Review* will be entirely devoted to Radium Therapy, this being the fifth annual "Radium Number." Short original articles on clinical radium therapy that will be of interest to the general profession are solicited. All contributions should be in the hands of the Editor (P. O. Box No. 152, Quincy, Illinois) not later than February 20, 1932.

BOOK REVIEWS

THEORY AND PRACTICE OF TELECURIETHERAPY. By MAX CHEVAL and A.-P. DUSTIN. Pages, 240; illustrations, 76. Masson et Cie, Paris, 1931. Price, 34 francs.[1]

In this work of clinical radiologic and biologic research will be found most valuable technical instruction, as the authors' main purpose was to relieve radiotherapists seeking information in this field of the inevitable initial uncertainties.

This volume, which sums up a three-year experiment along clinical and therapeutic lines, consists of three divisions.

The first part is devoted to the organization of a telecurietherapy station and the technic of treatment.

Then comes an investigation of the biologic action of telecurietherapy on both general conditions and on tissues or various malignant cells.

In conclusion, the authors deal with clinical considerations referring to indications of technic in different cases of neoplasms. They report a number of observations, to which they add the enumeration and results of all the cases treated in three years.

L. M.

Translation by HENRY BAYON, M.D.

PHOTOBIOLOGIE. By LUDWIG PINCUSSEN, M.D., Phil. Direktor der Biolog.-Chemischen Abteilung am Stadt, Krankenhaus am Urban, Berlin. Pages, 543; illustrations, 101. Published by Georg Thieme, Leipzig, Germany, 1930. Price, 36 marks.

This is an excellent compilation of facts and theories concerning the action of radiant energy (ultra-violet, visible and near infra-red) on animal and plant tissues. The fundamental physical principles and the biological results obtained by various investigators, both in pure research and from the standpoint of their application to disease conditions as well as the maintenance of normalcy, are presented in a systematic and comprehensive form. The volume will be of particular value to those interested in ultraviolet therapy.

The first portion of the volume deals with radiation and the laws of radiation, absorption spectra, fluorescence, the qualitative and quantitative determinations of radiant energy in sunlight, arc and spark spectra, photo-electric effects and physico-chemical changes produced by radiation. Nearly seventy pages are devoted to chemical effects such as isomerism, polymerization, oxidation, and reduction phenomena and photosynthesis.

The second part (over 300 pages) of the volume deals almost entirely with the biological effects of radiant energy, chiefly ultra-violet. The absorption of light by living organisms, the regulation of this absorption and the development of pigment, the influence of light on the growth of cells, microorganisms, plants and animals, the effects on animal and plant metabolism, the influence of light on the nervous system, internal secretions, the blood, the skin and body temperatures, and the relations of light to the organ of sight are among the important topics which are considered and dealt with adequately but not in detail.

The text is replete with citations and adequate references are given. For instance, over 300 references constitute the bibliography of the chapter on the chemical effects of light. These references are to both foreign and American investigators and are brought down to the year 1930. The bibliography, in and of itself, is extremely valuable, as well as indicating the thorough acquaintance of the author with the field of photobiology. The book can be recommended to those who are desirous of possessing an up-to-date treatise on this subject.

[1] This review, in French, was published in *Bruxelles-Médical*, Oct. 4, 1931, XI, 1438.

SURGICAL PATHOLOGY OF THE DISEASES OF BONES. By ARTHUR E. HERTZLER, M.D., Professor of Surgery, University of Kansas, and Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kansas. Pages, 272, with 211 illustrations. Published by J. B. Lippincott Company, Philadelphia, 1931.

This volume is one of a series of surgical-pathological monographs, which the author has written or proposes to write. The publication is excellently illustrated with ample and clear-cut roentgen-ray reproductions and photomicrographs. The descriptions of the ordinary affections of the bones are well written and clear. For the use of the surgeon it is to be highly commended. The author makes no claim that it is for more advanced study of the diseases of bone. His claim that there was a need for a pathology of diseases of bones is true. He has filled this need for many.

The subject of bone tumors is well discussed. While the author does not adhere strictly to the classification of the Registry, his reasons for this are well taken. This particularly difficult subject leaves much to be desired in the literature, and the author has assembled the available knowledge in a comprehensive way.

The discussion of joint affections is not so satisfactory from the standpoint of one interested in these conditions. However, the book is on diseases of bones and it may have been the author's intention to pass over the subject of joints. In the discussion of tuberculosis, however, the statement that "there is even grave doubt whether or not the disease is ever primary in the synovial membrane," might lead to a considerable amount of discussion as the more modern conception of joint tuberculosis certainly does not subscribe to that statement.

As a guide to the pathology of the more common affections of bone we can recommend this volume.

EXPLORATION RADIOLOGIQUE DE L'APPAREIL RESPIRATOIRE. By EMILE SERGENT, Professeur à la Faculté de Médecine de Paris, Member de l'Académie de Médecine; FRANCIS BORDET, Ancien Chef de Clinique de la Faculté de Médecine de Paris, and HENRI DURAND, Chef du laboratoire de la Clinique de la Charité. With the technical collaboration of J. COUVREUX, Chef du laboratoire de Radiologie de la Clinique de la Charité. Published by Masson et Cie, Paris, 1931. Two volumes, 465 pages, with 639 illustrations including 580 radiographs. Price, 350 francs.

This excellent pictorial atlas of the chest has been prepared by eminent clinicians of wide experience. It is their purpose to correlate the roentgenologic findings with the various clinical signs, symptoms, laboratory and autopsy findings and thus place the interpretation of the roentgenologic changes in respiratory conditions on a more logical foundation. While this work is purported to be an iconographic atlas, such a description does not do justice to the accompanying text in which the multiplicity of intrathoracic shadows has been analyzed in an amazingly practical manner. The text is also replete with such information as is accumulated only from years of experience.

The first part (33 pages) is concerned with the technic of the roentgenologic examination. It is quite brief, but covers the practical essentials. The novice will wish that this subject had been considered in more detail, but, as the book is written primarily by clinicians, from their viewpoint

this omission of technical roentgenologic details may be pardoned.

The authors have analyzed the roentgenologic findings in a rather unique fashion, considering first the normal chest, later the fundamental pathologic changes, and lastly the more complex pathologic changes. The detailed description of the fundamental pathologic changes is most excellent, and the photographs of pathologic specimens add much to the value of the many excellent roentgenograms. The section devoted to bronchial affections is unusually comprehensive and is supplemented by many lipiodol studies. The cuts, typography, and binding are of superlative quality.

This is undoubtedly one of the finest books on the subject available, and even the experienced radiologist will find it of great value.

King George Knights Dr. Henry S. Wellcome.—Many friends and associates of Dr. Henry S. Wellcome in the United States will be gratified to learn that knighthood was conferred on him in King George's New Year honor list in recognition of his generous support of medical research. He is a native of Wisconsin and became a British subject by naturalization. He was graduated at the Philadelphia College of Pharmacy and Science. He is a Director of the Gorgas Memorial Institute of Tropical and Preventive Medicine, Washington, which operates scientific laboratories at Panama for research work touching causes and prevention of tropical diseases.

In connection with the monumental sanitary work of General Gorgas in Panama, it is recalled that at one time an attempt was made to cut down appropriations which would have seriously handicapped the progress of the work. The Secretary of War, the Hon. J. M. Dickinson, who knew of Dr. Wellcome's experience and interest in tropical research, asked him, while in Washington in 1910, to visit Panama and make a thorough, detailed inspection of the conditions and methods of operation in all sections of the Canal Zone and to submit an unbiased report based on his personal observations.

Dr. Wellcome is a life member of the American Pharmaceutical Association and has taken an active interest in its scientific work since the beginning of his membership in 1875. At the last annual meeting of the Association held in Miami, Florida, during July, 1931, he was elected Honorary President.

Dr. Wellcome has received world-wide recognition for his great service to science and medicine, for his interest in missionary enterprises, and for his personal work in medical research, the history of medicine, and for his archæological and ethnological explorations and studies.

ABSTRACTS OF CURRENT LITERATURE

CONTENTS BY SUBJECT

CHEMICAL

PHYSICAL

THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

J. N. Ané, M.D.
L. J. Carter, M.D.
John R. Carty, M.D.
Donald S. Childs, M.D.
B. J. DeLaureal, M.D.
Nathan Flax, M.D.
M. J. Geyman, M.D.
N. G. Gonzalez, M.D.
F. L. Grandstaff, M.D.
A. L. Hart, M.D.
E. T. Leddy, M.D.
Joseph Maldonado, M.D.
L. Marinelli
Raymond V. May, M.D.
Davis H. Pardoll, M.D.
Ernst A. Pohle, M.D., Ph.D.
Francis B. Sheldon, M.D.
J. G. Stephens, M.D.
C. G. Sutherland, M.D.
Jacob H. Vastine, M.D.
E. C. Vogt, M.D.
W. W. Watkins, M.D.
W. W. Whitelock, Ph.D.

THE ABDOMEN

Methods of Orientation in the Diagnosis of an Acute Abdomen. Alejandro I. Pavlovsky. Rev. Med. Cubana, October, 1931, XLII, 1228-1234.

This article is meant particularly for the instruction of the practitioner who, in order to make a responsible diagnosis, is forced to depend almost entirely on the history and physical examination of the patient. It is an article of bedside diagnosis when the laboratory is either not available or the urgency of the case is such that there is no time for such examination.

The author goes into minute details of history-taking and does a thorough physical examination. He leaves all laboratory examinations as a last resort. It does not mean that he does not believe in laboratory examinations, but he wishes to impress the practitioner with the fact that a diagnosis may be made in the absence of laboratory tests.

The reason for which this author leaves X-ray examinations to the last is that it is difficult to obtain reliable plates in urgent cases. He does not leave out or overlook the importance of the X-ray. On the contrary, he emphasizes the value of this examination, when possible to make it. He cites such examples as cases of perforated peptic ulcers in which the presence of air in the peritoneal cavity will clinch the diagnosis.

A volvulus of the sigmoid colon and an ovarian cyst with a twisted pedicle give similar physical findings. By the use of a barium enema and the fluoroscope or X-ray films, a differentiation can be made. When the colon is filled the volvulus will show, but if it is an ovarian cyst, the colon will not show any irregularity but will be displaced upward and laterally. Thus, the author concludes by making the statement that X-ray examination is of inestimable value in many cases.

JOSEPH MALDONADO, M.D.

Exploration of the Abdomen by X-rays. C. W. Prowd. Canadian Med. Assn. Jour., October, 1931, XXV, 444-446.

This is the ninth in the series of articles being published in the *Canadian Medical Association Journal,* contributed by the Canadian Radiological Society, and dealing with physiotherapy in all its aspects. In this paper, the author keeps in mind the object of the series to educate the general profession, and sums up very concisely the progress which abdominal diagnosis has made since the advent of the X-ray.

A generation ago there was no X-ray. Today it is the greatest single factor as a diagnostic aid in all abdominal conditions. Not one but all the abdominal organs may be visualized either directly or indirectly. Exploration by X-rays forestalls examination by all other methods. No other means affords the same accuracy and certainty. It may even exceed inspection by the surgeon. Pre-pathologic conditions and disease in its incipiency are detected, as in malfunction of the gall bladder, stomach, and bowels. It has an important bearing on early diagnosis, and will loom large as a factor in preventive medicine. There are many unsolved problems to be attacked, but the accomplishment of the past gives promise for the future. We know the relative frequency and location of esophageal lesions, benign or organic. Cardiospasm and cancer, especially of the cardiac end of the stomach, are confusing, but the borderline case vanishes as the examiner becomes more expert.

We have learned that the large stomach, with so-called dilatation and prolapse, is peculiar to and characteristic of the asthenic type, and that it means no more than a long nose or a big foot, provided that it functions properly. Not more than 15 per cent of all cases with stomach symptoms have organic lesions of the stomach or duodenum. Duodenal ulcer is five times as frequent as gastric ulcer, and gastric cancer twice as frequent as gastric ulcer. Two-thirds of all gastro-duodenal lesions are duodenal ulcers, while cancer of the duodenum is the rarest of all lesions.

The X-ray has questioned or confirmed the accuracy of many statistics. Thousands of cases give decided values. The prominence of certain diseases has been lost. The liver and colon are often proved double offenders, and

the innocent appendix relegated to a minor part.

The liver and gall bladder are the frequent sites of disease. Opaque dye, administered orally or intravenously, has been of striking value in estimating liver and gall-bladder function and disease. Gall-bladder disease is the most frequent organic cause of dyspepsia, pain, and gastric symptoms. It is the source of trouble in about 25 per cent of all cases, and represents a higher percentage than the combined lesions, organic and functional, of the stomach and duodenum. The frequency of gall-bladder and colon disorders is more and more emphasized. They are closely interdependent. A constipated colon and a constipated gall bladder constitute dual and parallel conditions.

The secrets of the small and large gut are still largely unexplored or misinterpreted. No field offers more for research than the twenty-five feet of the small and large intestine. They still hold many secrets and remain the dark continent of the abdomen, with their intricate uncharted coast lines.

Roentgen data are invaluable to the urologist. Definite data are given by combined pyelographic and roentgenographic study. The new method of intravenous pyelography gives promise of much usefulness, especially as an aid to the regular pyelographic examination.

The female pelvic organs are examined by lipiodol, with good diagnostic results.

There still remain the spleen, pancreas, blood-vascular and muscle tissues to present problems for the future.

No field is too obscure, no effort too great, no problem too difficult for the realm of the X-ray. Never has sacrifice been so great as in this new science. There is need to-day of greater precaution and care, recreation and limited hours. The future is big with promise, the past replete with accomplishment, the present a high hour of endeavor. Men and material, medicine and physics, have worked together to solve and to throw light on the great unknown. The closed abdomen is revealed in the new light of twentieth century science.

(*Abstractor's Note.*—The abstractor reviews, with pleasure, such an article as this one, contributed by Prowd, and hopes that this somewhat extended abstract will stimulate more of our brethren to extend their efforts in the education of the general profession in the scope and accomplishments of our specialty.)

L. J. CARTER, M.D.

APPARATUS

A New Instrument for Measuring the Hardness of Roentgen Rays, Called "Durometer." S. Strauss and H.-Th. Meyer. Strahlentherapie, Oct. 3, 1931, XLII, 343-350.

The authors describe an instrument, designed by Schreus, which is based on the penetrometer of Christen. It permits the determination of the half value layer of roentgen rays by means of a fluoroscopic screen and a calibrated wedge. The percentage of error is said to be ± 5 per cent. For details of the construction, see the original article.

ERNST A. POHLE, M.D., Ph.D.

Purification of Radon. J. Bannon. Journal of Cancer Research Committee of University of Sydney, August, 1931, III, 86-89.

The author has designed a simple, liquid-air, radon-purifying apparatus which is quick in action, gives very satisfactory purifications, and is safer than many other types. It has been in use for fifteen months. When radon is not being drawn off, mercury protects the stop-cock leading from the radium container so that the grease on the cock is not decomposed, frequent greasing being then unnecessary. Although the design of the apparatus differs widely from the conventional pattern which was abandoned in favor of the present design, the methods employed are similar.

For preparations of the order of 300 mc., a concentration of 12 mc. of radon per cubic millimeter at a pressure of 25 cm. of mercury may be obtained. Thirty Muir seeds can be made in twelve minutes. For details reference must be made to the original paper.

J. G. STEPHENS, M.D.

Apparatus for the Sterile Catheterization

of the Bronchi. Armando Dei Rossi. Minerva Med., Oct. 6, 1930, XXI, 481, 482.

The author has developed an aseptic sound to extract specimens of the tracheo-bronchial flora, free from the bacteria usually present in the upper part of the respiratory tract. It consists of a curved tube having at one end two small jaws which can be opened or closed at will from the outside. A catheter is introduced into it, and the whole instrument, with its jaws closed, is lowered into the trachea; from there, by opening the jaws, the catheter may be pushed into one of the large bronchi.

The instrument has special importance also in bronchography, because it permits direct injection of opaque media in the lower parts of the bronchial ramifications. An X-ray photograph shows well how near the end of the catheter is to the diaphragm. The author has found the instrument perfectly satisfactory in the examination of 150 patients.

L. MARINELLI.

A Simple Uroselectan Outfit. O. LeGrand Suggett. Urol. and Cutan. Rev., October, 1931, XXXV, 666.

The author has devised for the administration of uroselectan a simple gravity apparatus which enables one to mix, sterilize, and administer the drug with a single container. A 125 c.c. Ehrlenmeyer flask, fitted with a rubber stopper penetrated by two pieces of glass tubing, is employed. One piece of the tubing is flush with the inside of the stopper, but protrudes an inch from the outside for attachment of the rubber tubing. The other piece is flush with the outside but long enough to come within half an inch of the top of the flask to permit the entrance of air. Three feet of tubing, with an adapter to fit a Schreiber or other intravenous needle, and a short section of glass tubing for a window near the distal end completes the apparatus. A clamp was found of great value by the author, for attaching the flask to either a horizontal or a vertical support.

J. N. ANÉ, M.D.

THE APPENDIX (DIAGNOSIS)

Roentgenologic Signs of Appendicitic Abscesses. Sigfrid Arnell. Acta Radiologica, 1921, XII, 359-368.

The author discusses the roentgen signs of appendicitis and especially those of appendiceal abscess. He feels that this phase of diagnosis has been neglected and deserves greater use in the examination of doubtful abdominal cases. No definitely direct roentgen findings are seen in uncomplicated appendicitis, but roentgen examination with or without the use of contrast medium is frequently helpful in showing lateral appendiceal abscess. He mentions the roentgen signs as described by Laurell and Westerborn (*Surg., Gynec. and Obst.*, 1931, LII, 804), these consisting of shadow of inflammatory process, haziness of renal contours, gas in abscess, appendiceal calculi, and contrast filling of fistulous tract and cavity.

M. J. GEYMAN, M.D.

Intussusception of the Appendix. E. W. Mitchell. Canadian Med. Assn. Jour., August, 1931, XXV, 194-196.

This is a case report of a patient, Mrs. P., married, aged 28, who was admitted to the Toronto General Hospital on March 28, 1931. There was no history of previous illness. Four days before admittance, at 6 P. M., she began to have dull epigastric pain. During the night the pain became more severe, spasmodic, and colicky in nature, and was referred to the region of the umbilicus. The paroxysms of pain occurred about every two hours, were short in duration, and agonizing. After each paroxysm of pain she felt absolutely well. There was no vomiting and she had a normal bowel movement.

She continued at her occupation for three days following the onset. During this period the paroxysms of pain continued, were definitely colicky, referred across the abdomen at the level of the umbilicus, and recurred about every two hours.

On examination the patient did not appear ill. The abdomen was scaphoid, and there was no visible peristalsis or mass. There was tenderness, without rigidity, on the right side from McBurney's point to the costal margin. The rectal examination was negative and the temperature and pulse were normal. The

white blood count was 7,600 and the urinalysis was negative for sugar and albumin; microscopically, there were a few pus cells.

She was admitted to the hospital, and a diagnosis of appendicitis was made. At operation the appendix could not be visualized, but at the junction of the tænia coli a depression could be seen into which the meso-appendix was traced. The appendix was felt as an elongated mass within the cecum. An attempt to reduce the intussuscepted appendix failed. The cecum was opened through and parallel to one of the longitudinal bands, the appendix was clamped at the base and removed. The opening in the cecum was closed and the wound closed in layers without drainage. The convalescence was uneventful.

A study of the literature shows that intussusception of the appendix is rare. At Mount Sinai Hospital, New York, in 5,000 operations for appendicitis, one case of intussusception of the appendix occurred, as reported by Moschcowitz. The author has been able to collect from the literature 70 cases, a few of which were probably not true intussusception.

The important points in the clinical history and examination are: the colicky pain, with definite remissions, the absence of rigidity, mass, and vomiting. The early recognition and treatment would save the more serious complications of massive intussusception of the bowel.

L. J. Carter, M.D.

Diagnostic Considerations Regarding Appendicitis, Chronic in Origin, and Gastric and Intestinal Manifestations. M. Trincas. L'Ateneo Parmense (Suppl.), 1931, III, 283-304.

On the basis of 150 cases, which he studied in detail clinically and radiologically, the author discusses the disputed question of the reflex action of appendicitis of chronic origin. The results of his investigations are summed up in the form of percentages of the total number of cases as follows:

Classic cases of chronic origin, with pain in the appendicular site or located anomalously, and with phlogistic complications of various nature, 132, or 88 per cent.

Forms prevailingly gastric, twelve, or 8 per cent. These were equally divided between hypersthenic and hyposthenic.

Forms prevailingly intestinal, six, or 4 per cent. Of these, forms with prandial diarrhea numbered two, with postprandial diarrhea three, and with spastic occlusion one.

W. W. Whitelock, Ph.D.

THE BLADDER

Leiomyoma of the Bladder: With a Report of a Case and a Review of the Literature. Herman L. Kretschmer. Jour. Urol., October, 1931, XXVI, 575-589.

A case of leiomyoma of the bladder in a young girl of nineteen is reported. The literature on this type of bladder tumor has been very well reviewed and is incorporated in the article. Frequency, etiology, age, sex, symptoms, diagnosis, treatment, and prognosis are considered. An extensive bibliography accompanies the paper. A cystogram is reproduced which demonstrates bilateral filling defects occupied by the tumor substance. Illustrations of the surgical specimen and photomicrographs of the author's case are also included.

Davis H. Pardoll, M.D.

A Case of Extroversion of the Urinary Bladder. J. S. McEachern. Canadian Med. Assn. Jour., September, 1931, XXV, 324.

The mother of a female infant, aged 12 weeks, noticed a mass protruding from the vulva, while the child was crying hard. At 4 P. M., the physician reduced the mass and sent the patient in for an examination. The mass recurred after a fit of crying while in the hospital. It was again reduced but the condition not diagnosed. Under an anesthetic the child was examined and the vagina and cervix appeared normal. The anesthetic was stopped and the child began to vomit. Slowly the urethral orifice was seen to dilate, and a mass was suddenly extruded from it. This mass quickly became a deep bluish black. Pressure between the finger and thumb flattened it out. Lifting it forward, the orifice of one ureter could be seen; the extroversion was easily reduced. The child was kept in bed with the

foot of the bed elevated for about a month. There was no recurrence of the trouble. Nine years later the patient was examined and nothing abnormal was found.

The parents reported that for the first two years the child had no urinary control. From that time on there was improvement in control and for the last three or four years it has been normal.

L. J. CARTER, M.D.

BLOOD CHANGES

Influence of Roentgen Irradiation on the Sodium Content of the Blood Serum. Karl Adler. Strahlentherapie, Oct. 24, 1931, XLII, 584-590.

The influence of roentgen irradiation on the sodium content of blood serum was studied in rabbits and in patients. In rabbits, which had received a surface dose of 1,000 r, the sodium content of the blood serum was decreased by from 6.54 to 15.4 per cent of the initial value. Patients who were treated with the usual roentgen and radium doses showed no changes in the sodium content of the blood.

ERNST A. POHLE, M.D., Ph.D.

The Influence of Roentgen Rays on the Alkali Reserve of the Blood. Kurt Käding. Strahlentherapie, Oct. 24, 1931, XLII, 571-583.

The alkali reserve of the blood is usually constant, but it can be influenced by a number of factors, for instance, disease, anesthesia, work, and irradiation. The values usually move towards the acid side, while alkalosis was not observed by the author. He found that in malignant tumors of the genital organs the alkali reserve is very low. Following roentgen irradiation it increases in some and decreases in other patients. Since only a small number of cases were studied, no definite conclusions could so far be drawn.

ERNST A. POHLE, M.D., Ph.D.

BONE (DIAGNOSIS)

Fracture of the Iliac Bone, with Sinking of the Acetabulum and Intrapelvic Luxation of the Femoral Head. Alberto Fernández Saralegui. La Semana Méd., Sept. 10, 1931, XXXVIII, 799-804.

The author presents this case because of its rarity. A man, 40 years of age, was struck by an automobile which was going at a low rate of speed. The blow caused him to stagger forward, leaving the right leg in flexion and the left leg in extension. While he was in this posture, the bumper of the car struck him on the external part of the left leg. He immediately felt pain as if a bone had been broken. His left leg remained in flexion and thus he was carried to the hospital.

Attempts to correct the vicious position resulted in a reduction of the flexion. On examination, the left leg was found in flexion, adduction, and internal rotation, with the left foot resting on the internal aspect of the right one and the left knee resting against the internal aspect of the right one. In the left hip, there was noticed a flattening due to total disappearance of the prominence produced by the greater trochanter. Measurements revealed a shortening of 5 cm. as compared to the right extremity. The Nélaton-Roser line was found in accordance with this shortening and so was the Shoemacker line. The deformity of Bryant's triangle was found in relation to the displacement of the greater trochanter. Rectal examination revealed the new position of the femoral head, with the piece of bone torn from the acetabulum in front of the femoral head. Radiographs showed intrapelvic luxation of the femoral head, measurements showing that it had penetrated so deeply as to reduce the size of the pelvic cavity about one-third. There was fracture of the antero-lateral segment of the iliac bone and also fracture of the lesser trochanter.

The treatment was instant reduction, massage for four weeks, and walking exercises after eight weeks. The results were good for that type of fracture.

N. G. GONZALEZ, M.D.

BONE (THERAPY)

Avulsion of the Lesser Trochanter of the

Femur. J. S. McEachern and H. N. Jennings. Canadian Med. Assn. Jour., October, 1931, XXV, 449, 450.

A healthy athletic boy, 16 years of age, was running to catch a street car. He slipped on some ice, caught his right foot in a rut, and saved himself from falling by a violent backward jerk of the body. There was immediately severe sharp pain in the right groin and the adjacent part of the thigh. After a few minutes he was able to walk to the street car, holding the right leg and hip stiff, and sliding the right foot along the ground.

X-ray examination showed the lesser trochanter of the right femur to be torn loose at the epiphyseal line and drawn upward and forward about 3 centimeters. The patient was put to bed and the right leg suspended in a bent Thomas splint, hung from a Balkan frame, with the hip flexed to 100 degrees. After the first day there was no pain. After four weeks in this position the leg was lowered by degrees, and in another week the patient was allowed to be up, with crutches. A second film taken at this time showed the epiphysis drawn back into partial contact with the diaphysis, about 2 cm. from its proper position, and good bony union had apparently occurred.

The authors call attention to the fact that avulsion of the trochanter is a rare injury. They have been able to bring the number of reported cases up to forty-eight. (*Note.*—The abstractor has one case which he has not reported.)

Common symptoms are pain in the groin, inability to flex the thigh, and, usually, inability to walk.

L. J. Carter, M.D.

BONE DISEASES (DIAGNOSIS)

Unusual Forms of Familial Osteochondrodystrophy. T. Dale. Acta Radiologica, 1931, XII, 337-358.

The author reports three cases of an unusual familial skeletal disease. They differ from chondrodystrophy in that the extremities are of normal length while the trunk is abnormally short. The disproportion becomes more pronounced as age increases. The most marked osseous abnormalities occur in the spine and consist of defects in ossification, resulting in various degrees of kyphosis and scoliosis.

Marked irregularity of the upper femoral epiphysis occurred in all three cases. Similar changes were also seen in the proximal epiphyses of the humerus in two of the cases, and of the distal forearm epiphyses in the first and third cases. The author believes the etiology to be on an endocrine basis.

M. J. Geyman, M.D.

Diffuse Bone Endothelioma (Ewing). Julio Diez. La Prensa Méd., Aug. 30, 1931, XVIII, 396-414.

The author presents here a good treatise on this subject, the purpose of which is to prove that such a tumor does exist. He follows the ideas of Ewing, Kolodny, and Connor. He gives a good review of the literature and presents photomicrographs and radiographs of the condition. Great praise is given to American investigators.

N. G. Gonzalez, M.D.

Chronic Tuberculous Hygroma of the Deep Trochanteric Bursa. Francesco Satta. La Radiologia Medica, November, 1930, XVII, 1251.

This article is a complete report of a patient suffering from hygroma of the trochanteric bursa. Radiologic examination disclosed not only the size of an extremely distended bursa, but also the diffusion of its contents to the surrounding tissues through the weaker points of its membrane.

L. Marinelli.

Femoral Condylitis: Report of Cases. Merrill Coleman Mensor. Calif. and West. Med., August, 1931, XXXV, 121, 122.

The author reports two cases which he has designated as femoral condylitis. The history is that of sharp boring pains on the outer side of the knee. X-ray examination shows a small defect over the external condyle about two

millimeters in diameter, with a small calcified mass about the same size adjacent to it in the soft tissue. This has been diagnosed as a small avulsion fracture and as a chip fracture with periosteal tear. As far as history by repeated interrogation can determine, trauma is definitely excluded.

The X-ray findings of an apparent fracture are not explained. In this condition are found all the signs of acute inflammation. Because of the conflicting reports of the inflammatory signs and the X-ray appearance, the relation of this condition to industrial medicine is important, due to a medico-legal aspect.

FRANCIS B. SHELDON, M.D.

The Diagnosis and Treatment of Acute Osteomyelitis in Children. Grover C. Penberthy. Jour. Michigan St. Med. Soc., June, 1931, XXX, 424-428.

The X-ray findings in the acute stage are of little value; at the end of four or five days, irregularities and changes in density may be made out. The history and clinical findings should be given to the roentgenologist to assist in the interpretation of the X-ray appearances. The best possible technic of obtaining bone detail must be used, and the examination should include the opposite limb for comparison. The age of the patient and the duration of the disease are factors which enter into the technic.

W. W. WATKINS. M.D.

Leprotic or Tuberculous Arthritis? Francesco Satta. La Radiologia Medica, December, 1930, XVII, 1395-1398.

The author has found an osteo-arthritic process under the astragalus, with phenomena of rarefaction and reabsorption on one side and osteoperiostitis on the other. The patient was affected with lepra tuberosa florida, although the general appearance of the lesion suggested that it was of tuberculous nature.

L. MARINELLI.

Malignant Osteoclastoma. J. W. Orr. Jour. Path. and Bacteriol., March, 1931, XXXIV, 265, 266.

A case is reported in which sections from the lungs of a museum specimen showed metastatic tumor nodules containing numerous giant cells of the osteoclastic type.

Subsequent investigation elicited that the patient had had the right leg amputated for a growth of the lower end of the femur. The microscopic diagnosis at the time of amputation was "myeloid sarcoma."

Note: "Myeloid sarcoma" or "osteoclastoma" are the terms used in England for what in America is known as benign giant-cell tumor of the bone.

E. C. VOGT, M.D.

Köhler's Disease in the Third Metatarsal Bone. Giuseppe Grado. Archivio di Radiologia, May-June, 1931, VII, 557-569.

According to the author, in the statistical review of Cahen-Brach, based on sixty-three cases in the literature, in only five was there involvement of the third metatarsal. His case, a boy of ten, had a characteristic lesion in the third metatarsal and the base of the phalanx with which it articulates.

E. T. LEDDY, M.D.

BONE DISEASES (THERAPY)

Metastasis of the "Benign" Giant-Cell Tumor of Bone (Osteoclastoma). S. C. Dyke. Jour. Path. and Bacteriol., March, 1931, XXXIV, 259-263.

The author reports a case of benign giant-cell tumor arising from the lower end of the femur, with metastases in the scalp, lungs, kidneys, ribs, spine, and mediastinal and peritoneal lymph nodes.

The patient was a male, 25 years of age, and the history extended over five years. He had been treated with Coley's fluid, but amputation was eventually resorted to.

The author was able to find recorded only one other case of this type of tumor, with metastases, the authenticity of which could not be questioned.

E. C. VOGT, M.D.

CANCER (DIAGNOSIS)

The Biopsy Question. Benjamin G. P. Shafiroff. Am. Med., November, 1931, XXXVII, 605-608.

The author discusses the importance of a biopsy in all lesions in which malignancy is suspected. A biopsy is believed to serve the following functions: To make a differential diagnosis; to aid in outlining the method of treatment; to determine prognosis, and to assist in research of the disease.

The treatment of malignancy varies with the type of pathology present. Surgery, X-rays, radium, or various combinations of these agents are employed, depending upon the condition present. In like manner, the highly malignant types of cancer require more radical treatment than the simple benign tumors. Of great importance before biopsy, however, is preliminary X-ray irradiation of the involved region to prevent direct extension and metastasis through the lymphatics. In certain lesions, such as carcinoma of the breast, all preparations should be made for immediate surgery in the event that the pathologist finds a malignant process.

Lesions of the cervical glands yield important information on biopsy analysis. Diagnosis of tumors of the face and extremities should be corroborated by biopsy. Biopsy is not as valuable in intra-abdominal and intrathoracic lesions, for the X-ray and bronchoscopic examinations reveal valuable information. The author believes that the portion of tissue removed for biopsy should be taken from the periphery of the tumor and should contain healthy tissue as well as the tumor tissue. A negative biopsy report may not mean that the lesion is not malignant, but a positive biopsy is always significant.

J. N. Ané, M.D.

Cancer of the Thyroid: Its Radiosensitivity. Cushman D. Haagensen. Am. Jour. Cancer (Suppl.), July, 1931, XV, 2063-2105.

The author studied thirty cases of carcinoma of the thyroid which had received radiation. He found considerable variation in response, these tumors by no means following the usual laws of radiosensitivity, particularly from the viewpoint of primary regression and definitive cure.

The various forms of thyroid cancer were grouped into five types, each type having a fairly characteristic natural history and morphologic structure.

The author finds that there is a moderate radiosensitivity in the less anaplastic types, particularly the adeno-carcinoma group. The most rapidly growing and anaplastic types appear to be uniformly radioresistant.

Emphasis is placed on the histologic structure of the tumor as well as size and extent in determining the type of treatment.

John R. Carty, M.D.

A Study of Cancer in Ex-service Men. Philip B. Matz. Med. Bull. Veterans' Administration, November, 1931, VII, 1010-1031.

In a thorough and complete study, the author analyzed 319 cases of malignant diseases which occurred in patients in government hospitals. Of this number, 317 were males and two were females. The series consisted of the following: 259, or 81.2 per cent, carcinomas; 49, or 15.4 per cent, sarcomas; one glioma; two teratomas, and three unclassified tumors.

Since the work of Maud Slye and the studies of Warthin support the opinion that heredity is an etiologic factor in malignant neoplasms, the author studied a smaller group of 52 cases of malignant tumors with a positive hereditary or familial history, or both. It was noted that 69.2 per cent gave an hereditary history of cancer; 21.2 per cent gave a familial history, and 9.6 per cent gave both a familial and hereditary history of cancer.

The most frequent locations of the tumors in this group were: The skin, lip, stomach, lymph nodes, rectum, buccal cavity, and bladder. It likewise was noted as a result of this study that the age period from 35 to 40 was the most critical one for the onset and incidence of malignant disease. No indication of a relationship existing between the type of occupation and cancer of a particular organ or site was observed, except in the group of 48 cases of cancer of the skin or mucous mem-

branes. In this group it was found that in 25 instances the patients were farmers or ranchers and thus exposed to the actinic rays and outdoor life of their occupations. However, of interest is the fact that 128, or 40 per cent, of the 319 cases of malignant disease gave a well defined history of previous irritation or inflammation. In the author's opinion, in 76 instances the malignant tumors might be attributable to smoking.

In reviewing the clinical records of the series of 319 cases it was found that 88, or 27.6 per cent, gave a history of having had some precancerous condition prior to the actual devolpment of cancer. The most frequent early symptoms and signs of malignant disease noted were: Tumor formation; pain; ulceration; bleeding, and loss of weight. The characteristics of malignant neoplasms were arranged by the author, in their order of frequency, as follows: Induration and ulceration; induration; ulceration; tumor formation and induration. The rate of growth of the malignant tumors was slow in 62.7 per cent of cases and rapid in 36.1 per cent of the series.

The diagnostic methods employed in these cases naturally depended to a large extent upon the organ affected. Clinical means and biopsy, therefore, were the most frequent procedures employed in 134 cases of cancer of the skin, mucous membranes, and buccal cavity. Clinical means, the X-ray, and exploratory operation were the diagnostic methods employed in 79 cases of cancer of the digestive tract and in ten cases of malignant tumors of bone. Likewise, it is of interest that 46 per cent gave a definite history of pain at the onset of the growth; 29.3 per cent developed pain after the onset of the growth, and 24.7 per cent had no pain at any time during the course of the disease.

Since the results obtained in the treatment of cancer are in large part dependent upon the early diagnosis and treatment of the disease, the author considered it of importance to study the period of time which intervened between the onset of the malignant process and its recognition and diagnosis. In this regard it was noted that 201 patients were treated for various conditions before a diagnosis of malignant tumor was made. Of the 201 cases, 105 were treated for periods less than one year and 25 from one to two years. In some instances patients were treated as long as twenty years before a diagnosis of cancer was definitely made.

Of 319 patients, 112 gave evidence of metastases. In a study of the sites of metastases it was found that in the case of carcinoma the sites in the order of frequency were: Lymph nodes, liver, lungs, spleen, pancreas, peritoneum, and bones. In the case of sarcoma the sites of metastases in the order of frequency were: Lymph nodes, lungs, liver, general sarcomatosis, kidney, spleen, ileum, and bones.

J. N. Ané, M.D.

Primary Cancer of the Ovary, with Invasion of the Peritoneum and Pleura: Uterine Fibroma. Temistocles Castellano and Severo R. Amuchástegui. La Prensa Méd., Aug. 30, 1931, XVIII, 389-396.

A woman, 50 years of age, was admitted to the hospital. She had been normal until she married, when she developed menstrual disturbances, such as pain, menorrhagia, and metrorrhagia. These gradually became worse as she grew older. The menopause came on at the age of 47 years. Seven months prior to admission, she complained of diffuse pain and heaviness in the abdomen. The abdomen seemed to increase in size; there was edema of the inferior extremities, accompanied by weakness and dyspnea. She consulted a physician who tapped her, obtained ten quarts of fluid, and advised her to enter the hospital.

In the hospital, after being tapped, she was found to have an irregular, hard mass in the epigastrium, extending from the ribs to the umbilicus. In the hypogastrium, there was palpated another mass which extended from the umbilicus to the symphysis pubis. Still other masses could be felt in the abdomen. Radiograms of the chest revealed invasion of the pleura on the right side. Biopsy of the abdominal tumor showed malignancy. Necropsy findings were a primary tumor of the ovary, with invasion of the peritoneum and pleura, and a uterine fibroma.

N. G. Gonzalez, M.D.

A Cancer Program for California. Lyell C. Kinney. Calif. and West. Med., May, 1931, XXXIV, 321-325.

The author gives some statistics regarding the increasing rate of cancer and its mortality and believes that the responsibility of the medical profession is greatly increased, due to the fact that the public is becoming cancer-conscious. The cure depends upon early diagnosis and immediate treatment. Most cancer is seen by the general practitioner first, and treatment most often is given by surgeons, whose experience may be limited to a very few cancer patients per year. One of the present problems of the profession is the accomplishment of early adequate treatment by skilled and experienced persons.

The author then notes the preventative measures of cancer by irradiation of the areas of irritation. He believes that the high mortality is due to the fact that most persons do not seek medical advice immediately. Not only must there be early diagnosis, but adequate treatment must be instituted at once, because the curable stage of cancer is very short. Once this time is passed the patient cannot be returned to a stage of curability. In the later stages palliation should be used with skill so as to make the patient more comfortable and to prolong life. Another problem is the education of the family physician to protect his patients from cancer by the treatment of precancerous lesions.

Since the diagnosis involves many technical procedures, and the program of therapy takes the judgment of an internist, a surgeon, a pathologist, and a radiologist, he believes there should be an institution for training and assistance in the diagnosis and treatment of cancer by the general practitioner. Such an institution should also carry out cancer research. The public should be taught that only in early recognition and immediate destruction of the growth lies the hope of cure of cancer.

FRANCIS B. SHELDON, M.D.

Carcinoma of the Lungs. Joseph Rothman. Med. Bull. Veterans' Administration, November, 1931, VII, 1044-1047.

Primary carcinoma of the lungs is believed to occur less frequently than the secondary type. MacMahon and Carman collected the records of 482 authentic primary carcinomas of the lungs. Ewing classifies pulmonary carcinoma as follows: (1) Carcinoma arising from the bronchial epithelium, usually of the squamous or cylindrical cell variety; (2) bronchial carcinoma from the mucous glands, found as nodular areas, usually smaller than the other types and located on the walls of the lower end of the trachea or the upper bronchi; (3) carcinoma from the pulmonary alveoli, usually of the cuboid or cylindrical cell variety.

While little is known regarding the etiology of primary carcinoma of the lungs, many authors believe that it is found in old cases of pulmonary tuberculosis. Secondary carcinoma represents the metastatic involvement of the lungs from a primary malignant focus elsewhere. The symptomatology in this condition depends on the location, variety, and condition of development. The differential diagnosis between pulmonary carcinoma and pulmonary tuberculosis is rather difficult in some cases.

J. N. ANÉ, M.D.

An Analysis of 1,347 Cases of Malignant Tumors of the Breast, with Special Reference to Management and End-results. G. W. Crile. The Journal-Lancet, Feb. 1, 1931, LI, 99.

Of the cases studied there were 523 available for end-result data; of these 284 (54.3 per cent) showed survival from three to five years; 196 (37.4 per cent) showed survival from five to ten years. With regard to radiation the author states, "Our radiotherapy department, under Dr. U. V. Portmann, and our surgical division are agreed on the following conclusions: our experience testifies against radiation before operation. A course of radiotherapy takes time—usually at least two weeks. Radiation of itself alone cannot entirely cure a case of carcinoma of the breast as securely as a complete surgical excision . . . As for post-operative radiation, Portmann, by an extensive statistical study of the comparative results of operations for cancer of the

breast with post-operative and without post-operative radiation, has convinced us that (1) the average natural duration of life for a patient with carcinoma of the breast is three years; (2) as a result of radical operation, about 38 per cent of the cases will be free from disease for the natural duration of life and about 30 per cent for five years; (3) with repeated superficial doses of radiation, at least ten per cent more patients may be expected to survive the five-year period."

W. W. WATKINS, M.D.

Carcinoma of the Cervix, with Twin Pregnancy and Normal Delivery. J. L. Blonstein. Lancet, Oct. 24, 1931, CCXXI, 903, 904.

The author was called in on an obstetrical case by a midwife because of prolonged first stage. There was very little progress during the next twenty-four hours, but the patient was delivered of a female child followed by a male child three hours later. There was no difficulty in delivery. The male infant developed pemphigus neonatorum on the fifth day and died on the eighth day. The female infant developed a similar condition on the sixth day and died on the ninth day. The mother had a normal postpartum convalescence until the thirteenth day. She had been allowed up on the tenth day. On the fourteenth day she developed pulmonary edema, became comatose, and died. Postmortem examination showed carcinoma of the cervix.

The author reports this case because of the following interesting points: The absence of any symptoms of carcinoma during the pregnancy; the absence of severe postpartum hemorrhage; the viability of the infants, and the probable infection of the infants with pemphigus from the carcinomatous area.

F. L. GRANDSTAFF, M.D.

Carcinoma of the Bladder with Vesicorectal Fistula. Robert Pollock. Urol. and Cutan. Rev., September, 1931, XXXV, 584-587.

Tumors of the bladder, which are more common in males, occur during the period from the fourth to seventh decades, and are found most frequently at or about the ureteral orifices and bladder outlet. The author believes that a papillary carcinoma frequently begins as a benign papilloma.

The initial symptom of an early carcinoma is generally painless hematuria, due to the following causes: Breaking up of papilla; ulceration and necrosis; instrumentation. The later symptoms are those due to infection, and those which result from obstruction at or near the bladder neck. In advanced stages pain is important, being caused by nerve involvement.

While the diagnosis may be suspected from the history, a careful physical, cystoscopic, and roentgenologic examination should be made. A rectal examination in males, or vaginal and rectal in females, may prove very valuable. Cystoscopy permits the operator to visualize the tumor mass and a cystogram gives information regarding the degree of involvement and extent. Routine X-ray studies of the pelvis, long bones, chest, and skull should also be made.

The author divides the treatment of carcinoma of the bladder into the following procedures: (1) Surgery; (2) high frequency electric treatment; (3) radiation with X-ray or radium, and (4) combinations of these methods.

The case of a male, 67 years of age, who was admitted to the hospital complaining of painless hematuria, is reported. Six months previous to admission a prostatectomy had been performed. Cystoscopy revealed a diffuse redness of the bladder mucosa, with thickening and loss of luster. Finger-like projections from the bladder neck and posterior urethra were seen. Cystography showed a constricted bladder with partial filling of the left ureter. Rectal examination revealed two firm masses occupying the prostatic bed. Radium was implanted into the prostatic bed and the patient was given transfusions and a course of deep X-ray treatments.

The patient was subsequently admitted for a third time, complaining of hematuria, frequency, pyuria, dysuria, and nocturia. Rectal examination at this time revealed a firm irregular mass filling the prostatic cavity. Blood

examination showed a leukocytosis. In order to ascertain the degree of rectal involvement. a barium enema was given and roentgenograms showed visualization of the bladder, right ureter, and kidney pelvis, besides outlining the rectum. The sigmoid appeared irregular and moth-eaten. Pyelography, with intravenous uroselectan, showed faintly outlined pelves and ureters, as well as bladder and rectum.

J. N. Ané, M.D.

Exeresis of Carcinoma of the Rectum. Victor Pauchet. Rev. Medicina y Cirugia, Habana, Sept. 30, 1931, XXXVI, 639-644.

The purpose of this paper is to emphasize the necessity of a rectal or proctoscopic examination and to rule out cancer of the rectum as a possible diagnosis in patients complaining of disturbances in defecation, blood in the stools, and a burning sensation in the rectum. Many cases become inoperable because physicians have passed them for cases of hemorrhoids or enteritis. The author goes into detail to show that there could be more operable cases if diagnosis were made early, and that the mortality in those cases is not as high as expected. He advocates the use of radium in inoperable cancer situated low in the rectum and X-ray in those higher up.

N. G. Gonzalez, M.D.

Cancer of the Lung. Antony J. Greco and Edwin J. Kehoe. Med. Bull. Veterans' Administration, September, 1931, VII, 876-883.

In 1810, Bayle described the rarest type of pulmonary tuberculosis and this report was considered by Menetrier as the first recorded case of cancer of the lung. Subsequently, other investigators confirmed Bayle's observation that pulmonary tuberculosis is frequently found associated with carcinoma of the lung. It is believed that the incidence of cancer of the lung has increased in recent years, due to the increase in respiratory irritants, which is believed to play some part in the etiology of this condition.

No characteristic symptoms or signs are observed in cancer of the lung. While cough, foul expectoration, hemoptysis, pain, dyspnea, fever, and cachexia are the outstanding symptoms, the symptomatology depends upon the location of the carcinoma and pressure upon the superior vena cava, the aorta, the heart, the recurrent laryngeal nerves, cervical sympathetic ganglia, trachea, or bronchi. Stivelman has recently shown that the lesion is most frequently found by lung specialists and correctly diagnosed by the X-ray.

It is agreed that the outcome is uniformly fatal in from two months to two years. Treatment is symptomatic, and Jackson believes that X-ray therapy is of palliative value and that this form of treatment causes shrinkage of the tumor and may prolong life for from four to five years.

The authors report a case of primary carcinoma of the lung, which was diagnosed during life, the patient living seventeen months. They also report a case of metastatic sarcoma of the lung, in which case the patient lived only ten weeks after the diagnosis was made.

The primary neoplasm of the lung occurred in a white male, 53 years of age, whose occupation was the oiling and greasing of automobiles. He gave a history of smoking a pipe, cigars, and many cigarettes, but the use of alcohol was denied. The family history was negative for any familial diseases or tendencies. He believed the onset of his illness occurred with fever, chills, cough, and pain in the chest. X-ray examination revealed the following findings: a homogeneous mass occupying the medial two-thirds of the left upper lobe; thickened pleura over the left upper lobe; scattered small densities at the left base: left diaphragm elevated, with a paradoxical movement suggestive of phrenic paralysis. Deep X-ray therapy was immediately ordered and the patient received many complete courses. While he constantly complained of loss of strength, putrid expectoration, and pain, his general condition remained good with no loss of weight for a considerable period. X-ray examination made the day before the patient died showed cavitation in the center of the mass, disseminated infiltration of the right lung, and the vertebral column convexly pushed toward the right side.

J. N. Ané, M.D.

The Diagnosis of Cancer by Spectro-photometry. Editorial. Canadian Med. Assn. Jour., September, 1931, XXV, 326, 327.

It has long been known that the blood serum of cancer subjects presents biochemical and biophysical peculiarities, as compared with normal serum. The hope has been that it would eventually be possible to devise a reliable specific test for the presence of cancer, based on such peculiarities. This hope has not been realized, but sufficient success has been obtained to warrant a continuation of the quest.

The editor summarizes the work that has already been done along this line, and calls attention to the recent important research of S. G. T. Bendien, of Zeist, Holland, which is attracting much attention at the present time. His technic is as follows:

The serum to be tested is flocculated by various mixtures of acetic acid and sodium vanadate, and the precipitate so obtained is dissolved in a 2 per cent solution of sodium bicarbonate. This solution is then subjected to spectro-photometric analysis. From a series of spectrograms the extinction coefficients are obtained, and from these a curve is plotted on which the diagnosis is based. Bendien does not claim that he can make an accurate diagnosis in every case of cancer, but he does say that a positive reaction is never found in any other disease.

In the light of these findings, Bendien holds to the view that cancer is a local disease which can develop only if a specific abnormality of the serum be present. Should this prove to be true, the implications are far-reaching. Not only may it be possible to diagnose cancer in the early stages but even before it has developed. In other words, it may be possible to detect the predisposition to cancer. Furthermore, it may be possible to determine more fully the biochemical and biophysical derangements that accompany and characterize the cancerous process, which, indeed, may prove to be the cause of cancer. This, at the moment, seems to be mere speculation. Yet, the studies of other workers point in the same direction. The experiments of Maud Slye, in which she was able to produce in animals a susceptibility of such high degree that 100 per cent developed cancer after the application of a simple irritant, are to the point here. Also, the experimental production of cancer by painting a skin surface with tar has shown that in it there are certain substances that have specific properties, for not every kind of tar will produce cancer.

Bendien's method has been subjected to rigorous test at the instance of the British Empire Cancer Campaign, as recorded by the *British Medical Journal.* Alfred Piney, Secretary of the Investigation Committee of this organization, went to Holland, taking with him thirty-eight tubes of blood serum collected from patients suffering from various diseases. Bendien examined twenty-one of the specimens and of these he diagnosed five as from cancer patients, all of which were correct. The British Empire Campaign Committee is satisfied that a distinct advance in the diagnosis has been made. Of course, time must be allowed before these findings can be properly appraised. Much more work must be done, and by observers in other lands as well. The investigation is being started immediately at the Cancer Hospital in London.

L. J. CARTER, M.D.

CANCER (THERAPY)

The Position of Surgery and Radium in the Treatment of Oral Cancer. Earl C. Padgett. Jour. Kansas Med. Soc., May, 1931, XXXII, 167-172.

He who presumes to treat cancer should have a well balanced combination of pathologic, radiologic, and surgical knowledge and should be in a position to use all three. Epidermoid carcinoma in and about the face, mouth, and jaws has a fair prognosis when all phases of the picture are taken, and sound methods of attack used. The end-results depend on the completeness of the eradication of the local lesion and the tributary lymphatic areas. When bone is involved, radium does not effect a cure unless necrosis is produced, so that as a rule excision becomes obligatory. Radium will not destroy the metastatic lesions of epidermoid carcinoma. The best methods

of treatment of the individual case should be chosen when the cellular characteristics, the probable irradiation response, and the chances for cure by excision methods are all considered.

W. W. WATKINS, M.D.

Carcinoma of the Mucosa of the Cheek: Radiation Treatment and Clinical Reports. Luigi DeVecchi. La Radiologia Medica, December, 1930, XVII, 1399-1432.

This article is an extensive clinical report of twenty-eight cases of carcinoma of the mucosa of the cheek observed by the author at the Institute of Radiology of the University and at the Cancer Institute of Milan. He favors radium therapy for the primary lesions of the mucosa and surgical intervention for metastatic adenopathies.

L. MARINELLI.

Radiotherapy in Cancer of the Upper Air Passages. W. Douglas Harmer. Lancet, Nov. 14, 1931, CCXXI, 1057-1063.

The author circularized a letter to all leading laryngologists and to many prominent clinics, and received seventy replies, the majority of these making it quite clear that radiation treatment had been of little value to them. He thinks that their opinions are due to improper management of the cases and stresses the importance of early diagnosis and treatment by radiation specialists.

After X-ray treatment the following post-irradiation changes are noted: Total disappearance of the growth, fibrosis or partial healing, edema, X-ray sores, necrosis, pain, and mortality. There is a short discussion under each heading.

The author discusses the operable, the borderline, and the inoperable groups of malignant tumors of the larynx, the hypopharynx, the nose, nasopharynx, tonsil and mesopharynx, palate, and cheek. Endothelioma and transitional-cell carcinomas and lymphoepitheliomas are treated separately, giving their most common site of appearance.

The author, after reviewing the collected cases of carcinomas, sarcomas, and endotheliomas, believes there is a great future for radiotherapy if treatment is properly handled. The authorities should prevent agencies from loaning radium to anyone except a recognized expert, and the patient ought not to be handed over to the pure radiotherapist who has no clinical knowledge of the disease that requires treatment. Great palliative relief can be afforded by X-ray treatment to a large percentage of advanced cases of cancer, and it is safer to treat the virulent types of cancer with X-rays rather than with surgery alone.

F. L. GRANDSTAFF, M.D.

A Method of Palliative Treatment of Carcinoma of the Esophagus. D. W. Gordon Murray. Canadian Med. Assn. Jour., September, 1931, XXV, 271-275.

Carcinoma of the thoracic esophagus has baffled all attempts at cure, except in a very small number of cases. Treatment by operation has but very few successful reports. Radium and X-ray therapy have been ineffective, partly because of the inaccessibility, and partly because of the common type of growth which is resistant to radiation. Quite massive growths, indicating a fairly late condition, exist in the esophagus without causing marked symptoms. Again, patients with obstruction to swallowing usually carry on with any form of food that will go through. Only when fluids cause difficulty do they seek relief.

All these conditions compose a picture of late malignant disease in an organ that is almost inaccessible, the treatment of which has vexed the medical profession for centuries. Gastrostomy or enterostomy to prevent starvation has been the method of choice in the past, but some have used various methods of intermittent dilatation. Neither of these procedures has been satisfactory even as a palliative.

Consideration of these facts led to a method of treatment for palliative purposes, of the principles of which Simmonds and, later, Souttar, were the first exponents. The aim is to dilate the stricture and pass through its lumen a tube which will prevent closure by spasm or growth. This allows the passage of any sort of food in the diet provided it is first minced.

so sustaining the strength of the patient. It also eliminates the symptoms of obstruction and regurgitation of mucus, and precludes the method of feeding by gastrostomy, which prevents the patient from following most occupations and shuts him out from society generally. These benefits give the patient a different attitude towards life and relief from apprehension for the future.

Details of the operation of passing the tube, after dilating the stricture, through the esophagoscope, are given.

In the growths about the level of the bifurcation of the trachea, which comprise about 60 per cent of all esophageal carcinomas, this method may be used in practically all. In the lower part of the esophagus, comprising about 30 per cent, the growths tend to be more vascular and softer in consistency, with a greater tendency for the tube to drop through. Again those at the cardiac end are of the same type, but here one added objection is that the stomach contents regurgitate through the patent cardiac orifice, requiring these patients to be nursed in Fowler's position. Hypopharyngeal and post-cricoid growths are unsuitable.

The contra-indications to this method are advanced constitutional disease, so advanced as to preclude the giving of ether anesthesia, local conditions such as aneurysm of the aorta and tracheo-esophageal fistula, and osteo-arthritis of the cervical region, making full extension of the head impossible.

Ten interesting case reports are appended to the author's discussion. The patients all secured relief from symptoms, namely, obstruction to swallowing and mucus in the throat, for periods up to ten months. All of them, except one, were able to follow their usual occupation. Some were alive at the end of the interval reported, some had died from metastasis elsewhere, some from hemorrhage, and some from other diseases. In no case did the postmortem examination reveal any ulceration caused by the tube.

L. J. CARTER, M.D.

Remote Results of Treatment of Cancer of the Rectum. Roger Savignac. Arch. d. mal. de l'app. digestif, June, 1931, XXI, 710-722.

Seventy-three cases are followed and the author's general impression concerning treatment is given. Deep radiotherapy is considered useless and at times dangerous, while the use of radium is useful, especially in inoperable cases or cases refusing operation. Following its application the growth often recedes, and the pain and discharge lessen.

Functional disturbances usually occur for two or three years before the patient seeks relief and then he is likely to die about six months later. Colostomy should be reserved for inoperable cases when defecation becomes painful, tenseness occurs, the discharge increases, and the general condition becomes bad, since this procedure is of no help except when danger of obstruction occurs as indicated above. It should be done if radium therapy is needed, as it can best be applied through the colostomy. The immediate mortality is 30 per cent; among cases not operated upon, 40 per cent. Of the group reported, seven out of twenty-six survived, five of the seven living more than five years—one for nine years and two are still alive after ten years. There is but one chance in three to survive. The results justify the risk on the following conditions: (1) Selection of operable cases on the basis of their ability to resist the extreme shock; (2) age; (3) condition of other organs and general constitution; (4) absence of metastasis; (5) size, location, and mobility of the tumor through rectal manual and proctoscopic examination, and (6) preparation of the patient.

B. J. DE LAUREAL, M.D.

Irradiation of Carcinoma of the Cervix Uteri. Harry H. Bowing and Robert E. Fricke. Minnesota Med., March, 1931, XIV, 237-244.

The results of radiation are fairly constant throughout the world, though the diversity of methods of treatment is surprising. The authors review the methods employed in the following clinics: Regaud's, where continuous irradiation over long periods of time is the distinguishing characteristic, and where.

in a total of 350 patients, 70 per cent of five-year cures were obtained; clinic of Forssell and Heyman in Stockholm; Wintz in Erlangen, who uses roentgen irradiation entirely; Döderlein Clinic in Munich, where combined radium and X-ray are used; at Zurich, where Fürst advocates roentgen treatment followed by radical hysterectomy; Radium Institute of Brussels; Baltimore, where Kelly and Burnam give massive doses in one treatment; University Hospital in Philadelphia; Memorial Hospital in New York; Woman's Hospital in New York; Schmitz of Chicago; Huntington Memorial Hospital in Boston; Schreiner of Buffalo; Pomeroy of Cleveland.

The technic at the Mayo Clinic is described, being similar to that many times described by these authors in various publications; their five-year results in cases treated between 1915 and 1924 were published in the March, 1930, issue of *Minnesota Medicine*. The Mayo Clinic method lies between the massive dose and the fractional dose, embodying some of the advantages of each.

W. W. WATKINS, M.D.

The Massive Dose and Fractional Methods in Radiation Therapy of Cancer. Leopold Freund. Acta Radiologica, 1931, XII, 315-336.

The author presents a thorough and very interesting history of the development of radiation therapy since 1896. He finds proof of its merit in the fact that it is in high repute thirty-five years after its introduction, and in its extension to new fields.

Soon after Roentgen's discovery, skin changes following exposure to X-rays were observed by men using the new radiation. By 1896, depilation and other changes in the lesions of lupus, unaccompanied by damage to adjacent tissues, were observed. Soon after this, Senn obtained favorable results in leukemia by X-ray treatment and Albers-Schönberg demonstrated experimentally that the testicle could be destroyed without visibly injuring the skin. These early discoveries showed that X-rays had a selective action and stimulated efforts to develop radiation therapy for cancer.

Before long it was found that the actively dividing epithelial cells of a malignant tumor are particularly sensitive to radiation, while the resting cells which are not dividing rapidly are but little affected. This destruction of mitotic cells is due to the direct action of the radiation upon them. Whether or not there is also an indirect action manifested in hyperemia, reactions in the connective tissue of the tumor, stimulation of enzyme formation, etc., is still not definitely known.

Freund states that he regards himself as the first student of radiation to prove the following points: (1) Roentgen irradiation has a biologic action; (2) this action has therapeutic value; (3) radiation possesses also certain dangers; (4) the action of radiation is cumulative. He also recognized early the necessity of large doses and heavy filtration.

It was not many years before the first crude apparatus for generating X-rays was improved and the technical advance begun, which has finally resulted in our modern high tension transformers with their high voltage current and great intensity. This improvement in machinery caused Albers-Schönberg to develop the idea of giving the whole dose of radiation at one sitting and in a few minutes. This was the beginning of the massive-dose technic in therapy.

At this time there were no really accurate methods of measuring small quantities of radiation. However, it was comparatively easy to measure the large amounts used in these single massive doses; hence the exponents of this method considered theirs an accurate way and the fractional method an inaccurate one of administering radiation. In spite of the widespread acceptance of the massive dose technic, there were a number of radiologists—the author being prominent among them—who believed in the fractional method and continued to study and use it.

As early as 1902, the author reported a case of carcinoma of the mouth greatly improved by treatment by the fractional method. During the next twenty years many other similar reports were made concerning recurrent nodes, diffuse carcinoma of the mesenteric glands and the peritoneum, sarcomatous me-

tastases, etc. Although the individual doses in the fractional method were small, the total dose was large and the tissue-effect was more nearly continuous and constant than in single massive doses. The facts that there is no great difference in sensitivity between cancer cells and normal tissue and that the cancer dose must be large rendered damage to healthy tissue more probable in the massive dose method. Furthermore, these large doses did not completely destroy the tumor. Weichselbaum, at autopsy on women treated by massive radiation for carcinoma of the pelvic organs, found that the cancer was not destroyed and that fistulæ and necrosis followed the treatment. The patients died in great suffering which was markedly increased by their reaction to radiation.

By 1919, it was established that the biologic action of radiation obeys Schwarzschild's theorem: "The effect of radiation is delayed the longer the interval between treatments is in proportion to the single treatment, the shorter the individual treatment, and the smaller the intensity of the radiation." Thus, the biologic action of the fractional method appears gradually rather than suddenly.

In the same year Regaud, during his study of cases of cancer of the tongue in the Radium Institute at Paris, observed in the patients treated with large doses more damage to the normal tissues and less destruction of the tumor than in those treated with small, daily doses. From this time on, the fractional method has grown in popularity. The protracted use of small doses is called the saturation technic.

In the modern saturation method there are several important features: (1) The use of small, individual doses; (2) the prolongation of the radiation; (3) the high total dose; (4) the hardness and homogeneity of the radiation accomplished through heavy filtration and increased distance. The advantages of this method are the increased destructive action on cancer tissue and the decreased local and general reaction to the treatment.

The author considers the prolongation of the radiation as important as the large total dose. During a protracted series of treatments, the tumor remains for a considerable period in a state of continuous radiation reaction. Research has shown that single organs of the body and even single cells possess varying sensitivity to radiation at different times. Because of this variation in sensitivity, prolonged radiation is likely to be more effective.

Severe local reactions are not seen in the fractional methods, and serious general reactions occur only in moribund patients. The author in his thirty-five years' experience has never had severe general reactions or serious injury to the skin in cases treated by the saturation technic.

In general, the fractional method is peculiarly adapted to carcinoma arising from the pavement epithelium of the skin and tending toward cornification. It is less effective in carcinoma arising from glandular tissue. It must not be imagined that there is no place for massive dose technic in radiation. If the tumor is growing rapidly and possesses high sensitivity, one should give a single, large, destructive dose, disregarding the possible reaction, in order to destroy the tumor quickly and completely. On the other hand, with deep tumors which are not very sensitive and grow slowly, one should use numerous smaller doses, all of which are above the threshold of therapeutic activity. With still deeper, larger tumors that are not very sensitive, larger doses at longer intervals are indicated in order to utilize both the destructive action of the larger individual dose and the selective action of prolonged radiation. In deep-seated lesions one should use heavy filtration and increased tube-skin distance.

No set rules can be formulated for fractional radiation. One of its advantages is that it can be adapted to the type of lesion under treatment. The length of the individual treatments, the length of the intervals, and the total dose will all differ according to the case in hand. The author, himself, has had good results when he has treated patients daily during a period of from fourteen to twenty-one days, using one or several portals of entry, depending on the size and location of the tumor, and employing hard, heavily filtered radiation. He repeats the series, if it seems best, after an interval of from four to six weeks. Freund

gives technical details of the methods advised by Miescher, Coutard, Schwarz, and Schinz. He emphasizes the fact that neither research nor experience has yet said the last word about the optimal size of the single or total dose, the length of the intervals between the treatments, or the duration of the series.

The selective action of the fractional method makes it valuable as a method of supplementing surgical removal of malignant growths; post-operative radiation may destroy malignant cells left behind the surgeon's knife. The author has urged, for many years, the radical surgical removal of neoplasms, followed by fractional radiation of the open, unsutured wound. This method is now beginning to be recognized by both physicians and surgeons.

Fractional radiation does not solve the cancer problem, but it deserves more consideration than it has hitherto received. One must not, however, go to the other extreme of abandoning entirely the massive dose, which has certain definite indications.

A. L. HART, M.D.

CHEST (DIAGNOSIS)

The Anteroposterior Projection of Oblique Profile for the Radiologic Examination of Only One Lung. Dino Tartagli. La Radiologia Medica, December, 1930, XVII, 1388-1395.

The author has described the technic elsewhere (*Rev. di Radiol. e Fisica Med.*, 1930, Fasc. IV, A). He reproduces several films obtained by this method and points out its advantages, especially in the study of interlobar fissures, of conformation of the diaphragm, and particularly in the localization of adhesions in therapeutic pneumothorax.

L. MARINELLI.

Some Considerations of the Interpretation of the Paramediastinal Shadow in a Case of Pulmonary Echinococcosis. Luigi Pinelli. Archivio di Radiologia, May-June, 1931, VII, 570-579.

The author discusses a case of paramediastinal pulmonary echinococcus disease in which there was nothing to suggest a cyst, the only symptom being the expectoration of bloody sputum. The author made the diagnosis after X-ray examination, and in this paper he discusses the differential diagnosis from a clinical and radiologic point of view, which led him to this conclusion.

E. T. LEDDY, M.D.

Two Cases of Exceptionally Long Delay in Eliminating Iodine after Bronchography. G. Cola. Archivio di Radiologia, May-June, 1931, VII, 525-536.

The first case was a girl who was examined because of the possibility of bronchiectasis. No bronchial dilatation or pulmonary cavity was revealed on X-ray examination, taken by the author's usual technic. The next day there was no change demonstrable in the bronchial shadows. The condition persisted for a week, when an attack of intense coughing brought on expectoration of the oil mixed with mucus. No untoward effect followed.

The second case showed, by bronchography, cavitation in the left base. The findings persisted for about a month and on the fortieth day there were shown only slight changes in the radiologic picture. These two cases are used by the author to illustrate the harmlessness of the examination.

E. T. LEDDY, M.D.

Cavitary Bronchospirochetosis. Ferdinando Talia. La Radiologia Medica, December, 1930, XVII, 1370-1387.

The author describes two cases of cavitary spirochetosis of the bronchi. Radiographic observations, practised systematically for three or four weeks, led him to conclude the following:

(1) The cure is extremely slow; (2) radiographic characteristics are much like those seen in pulmonary abscesses, namely, slight opacity at the center and marked opacity at the periphery; (3) reparation processes take place centripetally; the tracks left may be seen as bands or as stripes of radial shape originating from the cicatricial tissue; (4) ra-

diologic result is bound to guide the observer toward the right diagnosis, provided due attention is paid to biologic control.

L. MARINELLI.

Bronchiectasis in Children. Gladys L. Boyd. Canadian Med. Assn. Jour., August, 1931, XXV, 174-182.

Bronchiectasis has been regarded as a rare condition in childhood, despite the fact that from its earliest recognition as a disease entity its frequent inception in early life has been commented on by those who have studied it. Laennec, in 1825, reported a series of cases studied by one of his assistants, Cajol, some ten years earlier. In three of his four cases, the symptoms dated from early childhood. Very little further reference is made to the disease in the young until the close of the century, when its childhood origin is again referred to by Clark, Hadley, and Chaplin in their monograph on fibroid disease of the lung. In 1905, Clive Riviere described 33 cases, 23 of which began before five years of age. This author gave a classification of the main types of the disease, and also described its pathology and main methods of production. Since this time numerous articles have appeared dealing particularly with the etiology and pathology of the disease, but until 1922, when Sicard and Forestier introduced the use of lipiodol for the depiction of the disease, few have dealt with its clinical course or diagnosis. Case reports have been frequent since the discovery of these Frenchmen.

The author's report is based on the study of 56 cases observed at the Hospital for Sick Children, Toronto, during the past ten years. The diagnosis has been made possible largely by the use of the bronchoscope.

The age incidence has been from two months to ten years. The sex distribution was about equally divided between the male and the female.

The variety of pulmonary conditions with which bronchiectasis is associated makes it difficult to determine the causative factor. The consensus, however, assumes the bronchial dilatation to be secondary to some infection or injury of sufficient severity to disorganize the integrity of the bronchial wall. The persistence or severity of the infection, and subsequent infections, then increase the ectasis by the fibrosis produced in healing, or produce further destruction.

The following factors led to the disease in the author's cases: Bronchopneumonia 23; chronic bronchitis 7; measles and pertussis 5; pertussis alone 5; measles alone 4; influenza 4; empyema 4; tonsillectomy 2; lung abscess 2; cough 2.

No specific bacteria have been found. In the majority the infection was not only mixed, but the flora varied from time to time in the same patient. Cultures of turbid or even purulent fluid aspirated from the paranasal sinuses were at times disappointingly sterile. Hemolytic streptococci occurred alone or in combination more frequently than any other organism. The close relationship between bronchiectasis and tuberculosis was not brought out in this series.

Opinions differ as to the method of production of bronchiectasis, but all agree on its secondary nature. Two factors seem to be essential in the production of bronchial dilatation: (1) Obstruction of a bronchus, particularly if this be partial, and (2) infection. If the former is present without the latter the tendency is toward the production of emphysema rather than ectasis.

As to the gross pathology, probably the most striking feature is the degree and density of the pleural adhesions. This is seen even in infants. Bronchial dilatation develops with great ease in children suffering from bronchopneumonia, particularly in cases in which the latter is caused by measles, pertussis, or influenza.

From the standpoint of signs and symptoms, the most characteristic thing about bronchiectasis is said to be the very slight degree of impairment of general health. This view, so commonly held, has not been confirmed in this series. The children were considerably underweight, pale, and tired easily. They were seldom able to attend school regularly, and were subject to periods of exacerbation, when they had to remain in bed.

The important symptoms are cough—which

is always present—sputum, hemoptysis, dyspnea, and night sweats. Fever may be entirely absent.

Physical signs are not pathognomonic, in fact, may be entirely absent, except during a flare-up. Shifting of the mediastinum to the affected side may be observed. Clubbing of the fingers and toes is sometimes present. Albuminuria is seldom found.

The diagnosis may be made from the X-ray film. Sometimes the ordinary stereoscopic films may be sufficient to establish the diagnosis. The "honey-combing" seen in the lower lobes is pathognomonic. Fortunately, all cases have not progressed far enough to give this characteristic appearance. In such cases, the suggestive findings are extensive fibrosis, cardiac displacement, blurring of the cardiohepatic angle, enlargement of the hilus glands, with no other evidences of tuberculosis. The absence of these findings does not, however, rule out bronchiectasis.

The greatest aid in the modern methods of diagnosis of bronchiectasis, the injection of lipiodol into the bronchi, is described in detail by the author.

The prognosis is varied. Sometimes there is spontaneous recovery. Sometimes the condition progresses in extent of lesion and effect on the general health of the child. Very seldom does it progress to a fatal termination.

The treatment has been greatly changed in the last two years at the Hospital for Sick Children. Previous to that time the main attention was devoted to improving the general health of the child rather than to any attack on the disease process itself. The plan of treatment at present carried out is as follows: Bronchoscopic examination, with the injection of lipiodol in *(a)* unilateral cases—pneumothorax, repeated bronchoscopic suction, postural drainage—and in *(b)* bilateral cases—repeated aspiration, postural drainage, lipiodol.

It is too soon to make any statements as to the results of treatment.

L. J. Carter, M.D.

Pseudotuberculosis from Bronchospirochetosis of Castellani. G. Cola. Archivio di Radiologia, May-June, 1931, VII, 490-508.

This is a pulmonary lesion first described by Castellani, in Ceylon, in 1905, and which has been subsequently reported not only in the Far East but in most of the countries of Europe. The etiologic agent is the *Spironema bronchialis* of Castellani, which is present in enormous quantities in the sputum and in the bronchial mucosa of patients suffering with this disease. Clinical diagnosis is made by demonstrating the organism. The prognosis is generally favorable.

The treatment consists in the administration of arsenicals, antimony, or iodine. The author reports two cases of this rare disease and discusses the clinical and radiologic findings. The radiographic picture is not pathognomonic, but the essentials in it are marked enlargement of the hilar shadow, accentuation of the lung markings, the presence of striæ and scattered micro-granular spots in the upper half of the lung, and apical opacity and retraction.

The author emphasizes the importance of the recognition of this disease. The article concludes with a bibliography of twenty-two references.

E. T. Leddy, M.D.

CHEST (GENERAL)

Pleuro-pulmonary Complications Following Costal Fractures. Stefano Bistolfi. La Radiologia Medica, November, 1930, XVII, 1255-1308.

The conclusions reached by the author in a review of 1,800 radiographs of injured workers are as follows:

(1) Pleuro-pulmonary complications, due to fracture or trauma of the ribs, are not very frequent.

(2) The age of the injured may or may not be a factor, because although in youth greater elasticity of the organs diminishes the vulnerability of both ribs and underlying tissues, a greater yielding of the thorax would, on the other hand, cause a larger trauma area (between the ribs and pleuro-pulmonal tissues).

(3) The presence of lesions of the pleura and lungs following fracture of the ribs is a rather common occurrence according to radiologic investigation; it must be admitted, how-

ever, that these organs show a very marked resistance to traumatic agents.

(4) In healthy subjects, pleuro-pulmonary trauma is followed by local reparative processes, which take place in a short time and in a very satisfactory way, regardless of the seriousness of the lesion.

(5) Complications occur in weak patients, especially tuberculous ones.

The author advocates the most careful radiologic examination in cases of trauma or fractures of the ribs, so that the danger of impending complications may be effectively reduced in the most favorable period.

L. MARINELLI.

Intrathoracic Neoplasms. A. A. Rowan. Canadian Med. Assn. Jour., October, 1931, XXV, 401-407.

The author presents case reports of five admissions to Ste. Anne de Bellevue Hospital, Quebec, made during the last two years.

From a diagnostic standpoint, the author discusses the value of the radiograph. He considers that the value of the information gained from X-ray films and from physical signs, and particularly from the laboratory reports, is of most value from a negative standpoint.

The value of an X-ray film depends upon the area of lung presented to view and the clearness with which detail is brought out. In advanced cases such detail must not be obscured by pleural opacities. But even if only one side of the affected lung is shown clearly the films will be of value, as tuberculosis is usually bilateral, and affects chiefly the upper third. The withdrawal of fluid and its replacement by artificial pneumothorax as a diagnostic measure should be tried.

The chief interest of the radiologist in the author's series lies in the comparison made between the X-ray findings and the autopsy reports.

In the first case the X-ray examination showed a pneumonic area of the right upper lobe, the whole lobe being involved; thickened pleura on right diaphragm; trachea displaced to the right; left lung clear. The films showed an opacity above the interlobar line which might have been due either to pleurisy or to atelectasis. In the further course of the disease the entire right lung area became opaque from pleural effusion. The diagnosis was pleurisy with effusion; neoplasm on the right side, of bronchial or pulmonary origin, possibly with pleural involvement. Autopsy showed the right lung collapsed below and above the second and third ribs where there was a bridge of lung tissue between. The two pleural cavities so formed contained a quart of thin straw-colored fluid which was not blood-stained. The lung was hard and contained bronchiectatic cavities at the base. Microscopic examination showed primary carcinoma of the right lung, with extension to both layers of the pleura, to the diaphragm, to the mediastinal tissues, and the pericardium. There was also involvement of the diaphragmatic peritoneum and mesentery.

In the second case the X-ray examination showed the following: Outline of heart obscured but enlarged to the left; increased density at the right base; mottled area over both lungs. Appearance might be caused by a new-growth at the right base. A comparison of films taken a month later showed: *Right:* diaphragm not made out; ground-glass appearance up to the third and fourth ribs. Star, or cloudy vague-shaped areas seen down to the fifth and sixth ribs, with smaller and similar areas among them. *Left:* Heart shadow very irregular, merging with cloudy and fainter small areas resembling tubercules existing throughout the lung. Diaphragm made out with much haziness above it. Scoliosis of spine to the left. In comparison with the first films there seems to be a great extension.

The autopsy findings showed neoplasm of the right and left lungs, with metastases in the liver and mediastinal glands. Endocarditis is seen best in the aortic cusps. There are dense pleural adhesions. The microscopic findings are primary carcinoma of the right lung, with metastases in the left lung, pericardium, liver, retroperitoneal, and mediastinal glands.

In Case 3, the X-ray examination showed the heart, aorta, and trachea displaced to the left; an appearance of compensatory emphy-

sema of the right lung; left half of the diaphragm invisible; a dense area above it, suggestive of thickened pleura. This appearance might also be caused by fluid. This area extended from the base to the fourth rib in front; the heart shadow was half way out in the field. In two weeks' time the heart, aorta, and trachea were found displaced to the right. The lower two-thirds of the left chest were dense, with the appearance of fluid. In spite of repeated negative sputum examinations for tubercle bacillus, a diagnosis of pulmonary tuberculosis was felt to be the only explanation of the findings.

The autopsy showed a great ragged walled cavity in the lower two-thirds of the left lung. Microscopic examination revealed a primary epidermoid carcinoma of the left lung.

In Case 4, the X-ray examination showed a much enlarged heart, with broadened aortic shadow, suggesting aneurysm and fluid at the right base. Six weeks later the lower two-thirds of the right lung was uniformly dense, suggesting fluid or newgrowth. The heart and great vessel shadows were now of normal size. A diagnosis was made of cancer of the lung.

The author does not give the terminal result in this case.

In Case 5, the X-ray examination showed opacities on both sides of the chest, the upper borders of which were not clear or level. Above the level of opacity at the third rib there were no markings suggestive of tuberculosis or tumor. The heart and mediastinal shadows were almost indistinguishable from the general lower thoracic opacity. The diagnosis was failing cardiac decompensation, myocarditis, and pleurisy.

Autopsy revealed a massive tumor involving the whole anterior mediastinum and growing down over the pericardium. The heart, lung roots, and lungs and pleura were involved. The mediastinal mass was the size of a man's head, and occluded by pressure the great vessels, the esophagus, and the trachea. The microscopic diagnosis was lymphosarcoma.

Regarding the value of the X-ray examination in lung tumors, the author reaches the conclusion that it is only helpful in proportion as the extent of thoracic contents is visible above pleural opacities, should such be present.

L. J. CARTER, M.D.

CONTRAST MEDIA

Effect of the Radio-opaque Substances on the Walls of the Vessels. L. Docimo. L'Ateneo Parmense (Suppl.), 1931, III, 42-58.

The author believes that the employment of arteriography, when limited to the arteries of the extremities, is of evident value, especially in cases of embolism and obliterative thromboangiitis. It is, seemingly, the only method for determining with approximate accuracy the seat of the embolism or the point at which the eventual amputation of a member must be made in order to avoid the danger of excessive mutilation or of cutting into a segment insufficiently nourished, with all the consequences of defective vascularization of the borders.

The problem, however, despite all that has been written on the subject, has not yet been thoroughly studied, especially as regards the radio-opaque substances which should be employed. The opaque substances which have thus far been used for purposes of contrast have varied both in nature and in concentration, this variety seeming to indicate that each of them possesses both advantages and disadvantages, whereas it would be preferable to have recourse to a single substance recognized as the one best adapted to the needs of the case and as the least injurious. An opaque substance, in order to be applicable as a means of contrast in the circulating blood, should be harmless to the organism, should cause no disturbance of the circulation or alteration in the vascular walls, and, in addition, should give a clear image, so as to render the field of exploration distinctly visible.

For purposes of elucidating the problem, the author used dogs to study experimentally the effects, on the vascular walls, of solutions of iodide of potassium, bromide of sodium, iodide of sodium, and uroselectan, when used as means of contrast in arteriography. He found that, while the other substances give

rise to marked vascular alterations, uroselectan does not produce any changes, showing that it is completely neutral as regards the injected vessel.

W. W. WHITELOCK, Ph.D.

Pulmonary Angiography with Uroselectan. Adelchi Salotti. Archivio di Radiologia, May-June, 1931, VII, 633-639.

The author gives a preliminary report on some studies he has made on the circulation in the lungs and hilum and on the radiologic appearance of the superior vena cava. Some interesting findings were brought out which the author feels will be of greater importance clinically as the technic of the examination is improved.

E. T. LEDDY, M.D.

The Use of Iodized Oil by the Sanatorium Physician in the Diagnosis of Bronchial Affections. Stuart Pritchard. Jour. Michigan St. Med. Soc., July, 1931, XXX, 506-508.

Each method of visualizing the bronchial tree has its advantages. The supraglottic method is perhaps the least complicated, and most simple and time saving for the sanatorium physician, the clinician, and the radiologist.

This method does not require a trained specialist, and the injection causes the patient less strain and worry and little inconvenience. No ill effects have been observed by the author in six years of experience. The method may be employed in fluoroscopic room, office, or hospital, and any part of the bronchial tree may be visualized. It is useful in long-standing bronchitis of indefinite etiology, in cases of chronic cough with expectoration and no definite X-ray pathology, cases of chronic cough with history of pneumonia or foreign body, and in bronchiectasis. As stated in 1926, contra-indications are acute respiratory infections, acute or active tuberculosis, extensive or advanced pulmonary suppuration in a weak patient, advanced circulatory complications, and recent hemoptysis.

W. W. WATKINS, M.D.

DIATHERMY

Diathermy. E. P. Cumberbatch. Canadian Med. Assn. Jour., August, 1931, XXV, 164-167.

The only way in which external heat can get into the tissues is by radiation or conduction. The electric current, however, passes through the body and actually generates heat within the tissues. Heat which is generated in this way and distributed through the tissues is known as diathermy.

Currents like the faradic, galvanic, and sinusoidal are quite unsuitable for heating purposes within the body, because they would produce unbearable contractions of the muscles and dangerous changes within the tissues long before they reached a strength sufficient to heat the body. It is necessary, then, to deprive the current of its power to stimulate muscle and nerve and to produce chemical changes. This can be done by making it alternate, or oscillate, about a million times per second. This is known as a high frequency current. Not all high frequency currents will, however, produce a perceptible diathermy. High amperage must be used to produce heat.

The therapeutic properties of high frequency currents are due to heat, and heat only. By means of the diathermy current, the power of heat to relieve pain and spasm, to aid resolution of inflammation, and to assist the tissues in freeing themselves from infection, can be brought about in regions which are beyond the reach of other thermo-therapeutic agents. The therapeutic field of diathermy is, therefore, a wide one.

It is in the treatment of certain diseases of the pelvic organs in women that diathermy has made the most striking advances. By introducing a special electrode into the urethra and completing the circuit by means of a pelvic belt electrode, the part mentioned can be heated to 114° F. (the maximum bearable without pain) and freed from infecting gonococci, in about 90 per cent of the cases. The same is true of the cervix uteri, when treated in the same manner. If the infection is not gonococcal, it can be removed in about 80 per cent of the cases. By means of a spe-

cial vaginal electrode it is possible to remove infection of the fallopian tubes and the pelvic supporting tissues in the great majority of cases. Congestive dysmenorrhea can always be cured by diathermy, but the spasmodic type is only temporarily benefited.

In male subjects, the prostate and vesicles can be subjected to diathermy by way of a special electrode. This treatment will always bring gonorrheal fibrositis or arthritis to an end. In anterior urethritis, diathermy has no special value, but in gonococcal epididymitis and orchitis its action is remarkable.

There is sufficient evidence now to show that cardiac diathermy is valuable in angina pectoris. In cases of hyperpiesia the action of diathermy is to lower blood pressure and relieve the symptoms.

In some cases of chronic bronchitis the application of diathermy to the chest gives lasting relief. The same results have been obtained in some cases of idiopathic asthma. In lobar pneumonia, diathermy can relieve pain and produce sleep after all other methods have failed. It is of great value in mucous colitis.

Diathermy is of great value in surgery. Both malignant and innocuous growths can be heated and their temperature raised until the tissue proteins coagulate. This form of treatment has many advantages. There is no disturbance of the anatomic continuity of the growth, no cutting or scraping, and no loss of blood. The vessels are sealed. The patient does not suffer from shock after the operation. The resulting slough is quickly replaced by granulations, and the resulting scar does not shrink or form adhesions.

Latest developments are the diathermy knife and fulguration.

L. J. Carter, M.D.

DOSAGE

Energy Distribution in Deep Roentgen Therapy. Arduino Ratti. La Radiologia Medica, November, 1930, XVII, 1213-1250.

The author reviews briefly the work done in the field of roentgen dosimetry and the differential methods employed, giving a comprehensive picture of the errors which are apt to occur in determinations of this sort. His investigations were performed with a 155 K.V. constant potential machine, a H.V.L. of 0.85 mm. of Cu and under a filtration 0.5 mm. of Cu plus 3.0 mm. of Al. They consist of:

(1) Determination of the amount of secondary radiation present at the surface of a scattering medium (paraffin block $30 \times 30 \times 20$ cm.). This test was performed with five different dosimeters and showed an increase of from 36 to 43 per cent of the primary intensity at a T.S.D. of 30 cm. with 6×8 cm. field to 63 per cent with a field of 20×20 at 40 cm. T.S.D.

(2) Determination of the intensity at a depth of 10 cm., expressed in percentage, of the intensity at the surface, the results range from 28 per cent for 6×8 cm. field, T.S.D. equals 30 cm., to 48 per cent for a 20×20 field at 40 centimeters.

(3) Determination of the ratio of the intensity of the beam emerging from a given part of the human body to the intensity of the X-ray beam at the surface; this experiment was performed with the intention of checking the reliability of the results obtained in paraffin. No mention is made of the procedure followed, although the author admits that measurements on the body cannot be considered as technically exact as those made on the phantom; results, however, show no large discrepancy between the tests.

(4) Investigation of the conditions which are apt to decrease the intensity in a scattering medium.

This experiment includes the determination of absorption of vertebræ as compared with that of rice. No remarkable difference was found and indirect experiments confirm the belief that a large increase in the density of bones would not have affected the results.

Any effect due to the presence of bodies of high density (Cu, Pb, etc.) decreased as the size of the irradiated field was increased. The same general considerations apply to the study of "depth dose" in the skull.

(5) Investigation of the conditions which are apt to increase the intensity in a heterogeneous medium.

The conclusions reached are: The change in surface intensity is not affected appreciably by

the presence of air spaces in the phantom; within the medium they cause changes of the order of plus 17 per cent for air spaces located above the ionization chamber and of the order of from —4 to —6 per cent for lateral or underlying air spaces.

The author thinks, however, that, considering the conditions usually encountered in roentgenotherapy, measurements obtained from phantoms supply the values of doses at different depths of the human body with a reasonable degree of approximation.

L. MARINELLI.

What Is the Ovarian Dose in r Units? Heinrich Martius. Strahlentherapie, Sept. 12, 1931, XLII, 160-164.

The author has made an attempt to determine the average dose expressed in r necessary to bring about amenorrhea in women. He emphasizes that the figure derived from his statistical studies has no absolute significance, because too many variable factors enter into this problem. However, he comes to the conclusion that 290 r effective in the ovaries will in all probability sterilize the majority of women.

ERNST A. POHLE, M.D., Ph.D.

On the Principles of Balneologic Radium Therapy. Quantitative and Energetic Considerations of the Problem of Physiologic Dosage in Emanation Therapy. Jaromir Markl. Strahlentherapie, Oct. 3, 1931, XLII, 249-280.

The author analyzes in this paper the problem of dosimetry in emanation therapy, if the emanation is applied through contact (as a bath), taken in solution *per os* or inhaled through the lungs. He determined the amount of emanation in the blood for several hours after the administration and plotted the curves. This permitted the calculation of the energy per c.c. and second in erg. Following a bath in water charged with emanation the concentration in the blood increases up to a maximum and then slowly decreases. After four hours the major amount of the emanation has disappeared from the blood and only a small amount of activity remains.

Two types of curves were seen following application by mouth; one type with a steep slope and one with a very gradual slope. The rise of the emanation in the blood is rather rapid and reaches its maximum within a few minutes. The excretion varies considerably and is sometimes finished within an hour, sometimes taking more than two hours. The author states that after drinking about 200,000 M.E., approximately 10,368 alpha particles are effective in 1 c.c. of tissue during a two-hour period; this corresponds to an energy of 1.73×10^{-5} erg per second and cubic centimeter. In the emanatorium the concentration of the emanation in the blood increases slowly and reaches its maximum after an hour. It drops rapidly as soon as the patient has re-entered a room with ordinary air. Within four hours the greater part of the emanation has been excreted. As to the effectiveness of the three methods of administering emanation, it seems that the emanatorium where the emanation is inhaled takes first place. The author also discusses the possible mechanism of the action of emanation on the organism.

ERNST A. POHLE, M.D., Ph.D.

Suppurative Otitis Media. Pedro L. Errecarrt. Rev. Med. Cubana, October, 1931, XLII, 1218-1228.

In this article the subject of suppurative otitis media is thoroughly discussed from etiology to treatment.

The description of the necessary otoscopic examination is particularly instructive and quite complete. The author further discusses the differential diagnosis in detail, naming the most common conditions to be differentiated, and goes on to describe each condition.

In complicated cases in which the otolaryngologic methods of examination are not sufficient to accurately diagnose a condition, the author resorts to X-ray as a means of examination and finds it most valuable in determining or ruling out the presence of mastoiditis.

JOSEPH MALDONADO, M.D.

THE ESOPHAGUS

Esophageal Spasm in the Child. Enrico

Benassi. La Radiologia Medica, November, 1930, XVII, 1334-1345.

This is a description of two typical cases of this anomaly which is extremely rare in children. The patients were six- and seven-year-old girls. In both, the location of the spasm corresponded to the esophageal hiatus of the diaphragm. The author attributed its presence to nervous or hysterical phenomena in each case, his hypothesis being confirmed by the excellent results obtained by the administration of bromides and belladonna.

L. MARINELLI.

EXPERIMENTAL STUDIES

Susceptibility to Tumors: Some of the Factors Governing the Same. Charles L. Connor. Calif. and West. Med., May, 1931, XXXIV, 325-329.

The inoculable tumor may be transmitted by filtered juice or dried, presumably dead, tissue, but the transplantable tumor requires living cells. The purpose of the paper is to point out the laws governing these tumors, to indicate an analogy between experimental and human tumors, and to show how experimental factors may be altered.

The adaptation of the Rous fibrosarcoma to various strains of chickens is noted as an adaptation of tumor cells to animals, and in the adaptation of animals to tumors, reference is made to the Slye strain of mice and to the Buffalo strain.

The laws governing the transplantation of normal tissue are noted. But because of lack of genealogic knowledge, the factors regarding human-tumor susceptibility are less well-defined. There has been very little transplanting of human tumors.

Under the general subject of spontaneous retrogression of tumors an etiology has not been proven, and the chance of systemic therapy is very remote if the cause be found to be racial or hereditary. A number of factors is given which will alter the rate of growth or the susceptibility to tumors. The wide variety of methods used, the number of different species of animals studied, and the variation in types of tumors which are affected in different ways by the same substances indicate also that probably no single substance or method will ever be found that will have a uniform effect on all tumors.

FRANCIS B. SHELDON, M.D.

Some Biologic Effects of Radio-active Substances. Study No. 1.—Effects on a Transplantable Mouse Carcinoma. John W. Spies. Am. Jour. Cancer (Suppl.), July, 1931, XV, 2173-2181.

The author gave uranium-thorium mixture intravenously and subcutaneously to mice bearing Twort transplantable mouse carcinoma. He concluded that the radio-active substances accelerated the increase in volume of the neoplasm. This in turn shortened the span of life. The factors of necrosis, hemorrhage, and liquefaction could not be ruled out. Large doses of the uranium-thorium mixture produced acute nephritis in some instances, but small doses produced no anatomic lesions of the viscera.

JOHN R. CARTY, M.D.

Some Biologic Effects of Radio-active Substances. Study No. 2.—Effects on the Normal Rabbit. John W. Spies. Am. Jour. Cancer (Suppl.), July, 1931, XV, 2182-2201.

The author found that normal rabbits when injected with a uranium-thorium mixture showed no weight changes and there were no constant blood cell changes. There was a questionable lowering of the blood sugar level, but the cholesterol and blood non-protein nitrogen were probably not altered. Fecundation was not suppressed. There were questionable lesions superimposed on a previously existing spontaneous nephropathy.

JOHN R. CARTY, M.D.

Serum Anaphylaxis and Rays. Luigi Cappelli. La Radiologia Medica, November, 1930, XVII, 1308-1316.

This is an experimental study which follows many others by the same author on the investigation of the mechanism of the action of roentgen rays. The following conclusions may be drawn from it:

(1) Roentgen radiation tends to develop a physical and chemical action on vital colloids

which prevents or hinders spontaneous precipitation in rabbit serum.

(2) Flocculation is the result of physical or chemical conditions which are progressively established by anaphylactic process.

(3) Radiation, by opposing the establishment of these conditions, decreases both flocculation and anaphylactic charge, including the physio-pathologic phenomena of crisis and shock.

(4) Similar action of radiations on serum *in vitro* lends credence to the existence of antagonistic action of X-rays on the colloidal state of vital plasms independently of any cellular activity.

L. Marinelli.

Application of Radio-active Substances with Long Half Life Period in Medicine. A. Ostrěil and F. V. Novák. Strahlentherapie, Oct. 3, 1931, XLII, 291-306.

This is a preliminary report of experiments with a silver emulsion containing a radio-active deposit, which was injected in five cases with malignant tumors. The authors were particularly interested in obtaining a preparation with an activity of long duration. The ionization measurements and animal tests leading to the development of the preparation are briefly discussed. Although no definite statements as to the efficacy of this injection treatment can be made, the authors feel justified in continuing their work.

Ernst A. Pohle, M.D., Ph.D.

Tissue Metabolism Following Roentgen Exposure. Experimental Investigations on the Liver and Kidney. J. Heeren and J. Pansdorf. Strahlentherapie, Oct. 3, 1931, XLII, 307-327.

The authors studied the metabolism of tissue following irradiation. Liver and kidney of mice and rats were used for the determinations, which were carried out with the method of Warburg (manometer method). The roentgen exposure was given over the entire abdomen. The technic was as follows: 185 K.V., 5 ma., 0.5 mm. Cu, 30 cm. F.S.D., 550 r (in air). The amount of oxygen used by liver and kidney tissue was determined immediately and one hour following irradiation. If the tissue had been suspended in Ringer's solution, there was always a definite increase in the oxidation, both in liver and kidney tissue, lasting about 40 minutes. This increase was not found when the tests were carried out at a later time. The increase of the oxidation depended also upon the dose. If horse serum was used for the suspension of the tissue, the increase in oxidation could not be demonstrated regularly.

Ernst A. Pohle, M.D., Ph.D.

Some Effects of Ultra-violet Rays on the Vitamin D Content of Plants as Compared with the Direct Irradiation of the Animal. Mary Lojkin. Contrib. Boyce Thompson Inst., 1931, III, 245-265.

Standard white rats are fed a rickets-producing diet and tested for their response to sunlight, to ultra-violet irradiation, and to the curative effect of vegetables grown under different conditions. The amount of calcification was estimated by the $AgNO_3$ line test or by determination of percentage of ash in the femur.

Greenhouse plants did not produce Vitamin D. Ultra-violet rays from the sun and from the Hg vapor lamp impart antirachitic value to lettuce, alfalfa, spinach, and soy-bean, but none to cabbage. Greater antirachitic properties are imparted to the cut than to the intact plant. Such antirachitic activation is not destroyed in twenty-four hours. Complete protection was afforded rats exposed to the rays of the Hg vapor lamp for one minute per day. The wave length most effective is that within the limits of solar radiation. The time required for sunlight protection varies with the season. The exposure necessary to produce Vitamin D in the plant is proportionately longer than that required to impart protection by irradiation of the animal.

Chemical Abstracts.

The Repair *in Vitro* of Embryonic Skeletal Rudiments after Experimental Injury. Janet S. F. Niven. Jour. Path. and Bacteriol., May, 1931, XXXIV, 307-324.

In order to study the part played by the various constituents in the repair of bone following injury, fowl and mouse embryonic rudiments were cultivated *in vitro*.

It was found that results depend greatly on the period of embryonic life at which the injury is made.

For a detailed description of the processes that occur and the excellent accompanying photomicrographs, reference should be made to the original article.

E. C. VOGT, M.D.

The Effects of Repeated Intrapleural Injections of Electrolytes in the Rabbit—Acquired Insensitiveness of the Lung Epithelium to a Proliferative Stimulus: The Bearing of the Observations on Tissue Resistance. J. S. Young. Jour. Path. and Bacteriol., May, 1931, XXXIV, 357-377.

Hyperplasia of the epithelium lining the marginal alveoli of the lung of the rabbit can be produced by a single intrapleural injection of ¾ N solution of strontium chloride. A second injection within fifteen or twenty days of the first fails to produce further reaction, but at a longer interval it becomes effective again.

If injections are started with weak solutions, intercurrent hyperplasia can be prevented and finally no reaction is produced by an injection of N/I solution which would otherwise cause a severe reaction.

The reaction is not strictly specific, as calcium chloride affords some protection against strontium chloride.

It is concluded that these observations are consistent with the hypothesis that cell-division is initiated by precipitation of the colloids of the cell membranes.

E. C. VOGT, M.D.

Anaphylaxis and Rays: Alkaline Reserve. Luigi Cappelli. La Radiologia Medica, December, 1930, XVII, 1361-1369.

This article is essentially a review of the results obtained by the author on a long series of experiments performed on rabbits and human beings, which were previously published in the same journal. He concludes that, aside from a tendency to produce alkalinity in serum irradiated *in vitro*, roentgen radiation does not produce any noticeable change in alkaline reserve, pH, chloride content of the blood, or acidity in urine.

L. MARINELLI.

Experimental Rickets. T. Skaar. Acta Pediatrica, 1931, XII, Supp. I, 1-136.

This article occupies the entire supplement and gives in detail the extensive investigations of the author on the calcium, phosphorus, and magnesium metabolism in rickets. The purpose of these experiments was to examine calcium and phosphorus metabolism during the development, existence, and improvement of experimental rickets. Puppies were used as test animals. The experiments are well controlled and have to do with the effect of vitamin deficiency as well as the mineral intake. Some observations are also made on the effect of Vitamin C on the calcium and phosphorus metabolism.

The article is published in English and is accompanied by a comprehensive bibliography.

E. C. VOGT, M.D.

THE EYE (DIAGNOSIS)

Metastasis in the Sheath of the Optic Nerve from Carcinoma of the Stomach. Isadore Goldstein and David Wexler. Archiv. Ophthalmol., September, 1931, VI, 414-419.

The authors report a case of ulcerating carcinoma of the stomach metastasizing to the abdominal viscera and peri-aortic glands and the sheath of the optic nerve, with absence of visual disturbances. The invasion was probably through the blood stream. They report four cases on record, previous to 1922, arising from carcinoma of the breast, kidney, and bronchial glands, but none from gastric carcinoma.

RAYMOND V. MAY, M.D.

FOREIGN BODIES

A New Method of Localizing Foreign Bodies in the Eye. Teleradiography with

Visualization of the Cornea. Hugo Ahlbom. Acta Radiologica, 1931, XII, 212-235.

The author reviews all the past work on the localization of foreign bodies in the eye and, describing his method of localization, attempts to show its superiority over Sweet's method. Like Sweet, he attaches no contact markers to the eyeball.

In the Sweet method, the location of the foreign body is not gained directly from the plate, but is arrived at by a geometric computation of displacement with different projection angles, while in the author's method, the plates themselves show clearly in lateral and anteroposterior projections the actual position of the foreign body.

In the anteroposterior view, he uses a wire ring so placed that its center is in line with both the tube focus and the center of the pupil. He thus determines the relation of the foreign body to the center of the eye. In the profile view, obtained by an oblique position of the head and fixation of eyeball at right-angles to the X-ray beam, he uses an aluminum wedge against the cassette to make the cornea visible for a landmark. He thus determines the depth of the foreign body. Every detail necessary for the adoption of the method he explains carefully and for each step he gives the justification.

He points out the following disadvantages of Sweet's method:

(1) An expensive apparatus is necessary and the adjustments are complicated. The author, on the other hand, uses only appliances that are to be found in the regular laboratory equipment and which require no complicated adjustments.

(2) The short target-film distance causes some distortion, as much as 3 mm. being produced when the foreign body is situated far back in the eyeball. The author uses a tube-film distance of nine feet and there is no distortion.

(3) The patient may alter the direction of vision during exposure, as there is no means for directly observing him at this time. A comparatively slight change in the direction of vision results in considerable error. With the author's method, the patient is closely observed while the film is being taken.

NATHAN FLAX, M.D.

Foreign Bodies in the Air Passages: Their Diagnosis and Removal. William B. Faulkner and Edward C. Faulkner. Calif. and West. Med., July, 1931, XXXV, 12-18.

A history of aspiration is often overlooked but usually is very significant. The physical findings will depend, to a great extent, on the type of obstruction to the air flow, the position of the foreign body, and the amount of obstruction. The location and amount of secretion, also, will have a great deal to do with the physical findings. X-ray (fluoroscope and film) findings are very important. If the foreign body is opaque to the ray, it is easily located.

In non-opaque foreign bodies the diagnosis will depend on changes in the lung, which, in turn, will depend on whether or not the air passage is obstructed. If there is no obstruction by the non-opaque foreign body, the X-ray findings may be entirely negative. Then bronchoscopy must be resorted to. The authors discuss this procedure and the mechanics of foreign-body removal. The sooner the foreign body is removed, the less chance there is of complications.

FRANCIS B. SHELDON, M.D.

GALL BLADDER (NORMAL AND PATHOLOGIC)

Indications for Cholecystic Surgery. A. R. Monroe. Canadian Med. Assn. Jour., September, 1931, XXV, 276-279.

The object of the author is expressed as an attempt to adjudicate on the various methods of diagnosing cholecystic disease. Once disease of the gall bladder is established the organ should be removed. The results of gall-bladder surgery are so satisfactory that we may justly claim that the rules governing surgery of the appendix should apply to the gall bladder.

The history is important. Often in gall-bladder disease the history is sufficient to en-

able one to make a diagnosis without laboratory tests, and will almost always attract our attention to this organ when not sufficient to convict it of harboring disease.

The physical examination may reveal much or little. In most cases the history and physical signs are sufficient on which to make a diagnosis.

Cholecystography is a test of function rather than an estimation of disease. The functions of the gall bladder of which this test is an estimate are the ability to receive bile from the liver by way of the cystic duct, to concentrate and absorb it, and to empty it. The accuracy of the method is estimated at from 89 to 94 per cent. It would appear that cholecystography, although useful, has its limitations, and should be used as an assistant method in the diagnosis of cholecystic disease where symptoms are not definite and the diagnosis is obscure. This is often the case in chronic cholecystitis without stone.

Blood chemistry is important. The estimation of blood bilirubin is just as important in certain cases of cholecystic disease as a blood sugar test is in pancreatic disease. Frequent records of the van den Bergh test, kept graphically, will reveal a bilirubin curve. In a rising curve, the danger from hemorrhage, in the case of operation, is indicated. A falling curve indicates greater safety in operation, the danger of hemorrhage being lessened.

L. J. CARTER, M.D.

Is a Diagnosis of Strawberry Gall Bladder Possible? A Clinical and Radiologic Study. L. Feci and E. Ruggieri. L'Ateneo Parmense (Suppl.), 1931, III, 439-487.

This is an exhaustive clinical and radiologic study of nine cases of strawberry gall bladder. Two distinct classes of facts are given consideration in the radiologic examination: Those which result from observation of the digestive tube (especially of the gastro-duodenal tract), and those resulting from the cholecystographic examination. These two classes of findings show mutual interdependence and complete each other.

It must in truth be recognized that in the majority of cases the Graham test attains its maximum value insofar as the results are supported and strengthened by direct radiographic examination of the gastro-duodenal tract. However, there no longer exists any doubt in the minds of investigators as to the necessity of this combined method of examination of the biliary channels.

The authors make no claim to a categorical solution of the difficult problem which they have undertaken, contenting themselves with mere presentation of the results of their investigations.

Clinically, the disease is encountered primarily in young women, and is of short duration. It shows generally a painful gastralgic, atypic symptomatology (continuous rather than periodic pain).

Radiologically, the syndrome is that of indirect cholecystitis; the Graham test shows signs of diminished resorptive activity (retardation, rarely absence of the appearance of the image); morphologic alterations (non-uniform pallor, blending and irregularity of outlines, deformations) and functionally the disappearance of the images more quickly than normally, at times very rapidly.

W. W. WHITELOCK, Ph.D.

The Intravenous Administration of the Gall-bladder Dye for Diagnosis. G. T. Nordin. The Journal-Lancet, Jan. 15, 1931, LI, 41-43.

Films are made previous to the administration of the dye to see if the gall bladder or stones will visualize. This is the most important part of the examination. The dye is then administered and films are made five or fifteen hours later. A fatty meal is then administered and films are made two hours later.

A gall bladder is considered normal if it is not visualized prior to dye, if it fills within five hours, and decreases to one-fourth its former size after the fatty meal. Any gall bladder visualized before dye is given is abnormal, whether or not it subsequently fills. In 281 cases, 270 were found to be pathologic from X-ray findings; 36 of these showed stones prior to dye, 67 showed stones after dye. At operation, 268 of the cases showed

pathologic gall bladders; of these 221 had stones. Two patients were considered normal by the surgeon.

W. W. WATKINS, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

False Aneurysm of the Abdominal Aorta. W. A. Lincoln. Canadian Med. Assn. Jour., August, 1931, XXV, 197.

This is a case report of a patient, F. B., a white male, aged 42, who had syphilis about twelve years before. He had good health until nine months previous to examination, when he developed vague abdominal discomfort, gas, and indigestion. About two months before, while pitching hay, he developed very severe pain in the left abdomen, running down into the leg, and collapsed for a few hours. Examination at this time did not reveal any abnormality of the abdomen or left flank, and no definite diagnosis could be made. About a month later he developed a mass in the left flank, which increased in size until it filled the whole left abdomen, protruding noticeably in the flank and a little behind it. This extended up over the ribs and down to Poupart's ligament. It had a decided cystic feeling and gave an expansile pulsation. There was no bruit or thrill. Pulsation was present in the tibialis, posterior tibial region. There was no swelling or discoloration of the leg. The Wassermann reaction was positive; blood count examination practically normal. A pyelogram of the left kidney was normal, although the kidney was displaced upward. A barium enema showed the colon to be normal and running over the top of the mass. X-ray examination showed some erosion of the first three lumbar vertebræ. The patient ran a slight temperature, suffered severely from a boring pain, and failed rather rapidly, dying from exhaustion about four months after the onset of the first pain.

The postmortem examination revealed a large sac, practically filling the whole left side of the abdomen, with the colon lying over the top of it and the kidney pushed up in front and above. The anterior and internal walls were very thick, while the outer and posterior walls were formed by the body structures. The sac contained nearly three quarts of clotted blood and a great deal of laminated clot. There was erosion of the bodies of the first, second, and third lumbar vertebræ. The opening from the aorta was clear-cut, measuring one and one-half inches across and came from the aorta behind and slightly above the left renal artery. Sections of the aorta in this region showed slight fibrosis, but the remainder of the vessel was comparatively healthy.

These cases are not very common. Out of 18,000 autopsies at Guy's Hospital, there were 54 cases, and in 19,300 autopsies in Vienna, the condition occurred but three times.

L. J. CARTER, M.D.

Further Observations on the Operability of Gastric Cancer from the Radiologic Point of View. Alberto Anzilotti. Minerva Med., May 26, 1931, XXII, 804-807.

If the radiologic examination of a patient suffering from cancer of the stomach is to give a criterion of operability, it must furnish exact indications of the size and location of the tumor, of the conditions of the remaining parts of the stomach, and of the extent of the probable diffusion of neoplastic process to the surrounding organs. The author thinks that up to the present time radiologic investigation is diagnostically helpful but not entirely sufficient.

He reviews 148 cases of carcinoma of the stomach diagnosed during the last three years. Although 35 of them were judged operable, only 21 were operated upon on account of poor general condition and the presence of other diseases. Furthermore, in seven instances the surgeon had to limit himself to exploratory laparotomy, radiologic findings having failed to include metastatic involvement of hopeless extension. Gastro-enterostomy was performed in fifteen additional cases as a palliative effort in relieving stenotic ectasia.

The author reviews the radiologic signs leading to the diagnosis of cancer of the stomach; he agrees with Haudek upon the operability of the cancerous stomach which has preserved its hooked shape, and insists upon the importance of the study of the gastric

rugæ in the determination of the size of the lesion. He mentions two cases personally observed and surgically confirmed in which a total spasm of the antrum, due respectively to superficial ulcer and chronic gastritis, led to the hypothesis of epithelioma, which was discarded later because a careful study of the rugæ revealed the presence of spastic process. The difficulties encountered in the diagnosis of hepatic metastasis are pointed out by the author, who also states that one of the differential signs between ulcer and cancerous stenosis is to be found very often in the mechanism of digestion.

L. MARINELLI.

Epigastric Hernia of the Stomach. Osvaldo F. Mazzini and Domingo Brachetto-Brian. La Semana Méd., Sept. 10, 1931, XXXVIII, 807-809.

Since epigastric gastroceles are so rare that only one case has been reported in the literature, the authors present such a case in which the diagnosis was made both clinically and radiologically.

The hernia of this case was of eight years' duration and the size of a Brazil nut. It was symptomless. The lateral radiograph showed the gastrocele beautifully. The patient was operated on and hernioplasty performed.

N. G. GONZALEZ, M.D.

Phlegmonous Gastritis, with a Report of Four Cases. J. E. Pritchard and J. W. McRoberts. Canadian Med. Assn. Jour., August, 1931, XXV, 183-187.

Within the last three years four cases of phlegmonous gastritis have been met with in the postmortem services of the Montreal General, the Royal Victoria, and the Notre Dame Hospitals of Montreal.

The first case, a male, aged 19 years, had severe cramp-like pains in the epigastrium, immediately followed by vomiting. The tentative diagnosis was perforated peptic ulcer. At operation a thick greenish purulent fluid was seen to flow from the subhepatic region, a culture of which revealed hemolytic streptococci. At autopsy the stomach was large and dark reddish-brown in color. There were numerous subperitoneal hemorrhages over the whole surface, most marked along the greater curvature. The wall throughout was boggy, edematous, and markedly thickened. The mucosa was covered with grayish, turbid fluid, containing fine granular suspensions. The normal rugæ of the mucosa had disappeared and were replaced from the cardia to the pylorus by deep longitudinal troughs. Microscopic sections proved that the thickening of the wall was mostly the result of a marked edematous swelling of the submucosa. Scattered diffusely throughout and extending between the bundles of the muscular coat were abundant leukocytes (pus). The mucosa was relatively well preserved, with a much slighter infiltration of leukocytes. Sections through the pylorus showed a much more advanced involvement of the submucosa and muscular coats by the leukocytes, with necrotic fusion resembling an abscess. The anatomic diagnosis was phlegmonous gastritis, with exudative purulent peritonitis.

Cases 2, 3, and 4 were all discovered at autopsy. The anatomic and microscopic findings were the same as in the first case. Smears from the stomach wall and from the exudate showed abundant streptococci in all of them.

The authors review the literature of this condition. Although nearly always fatal, there have been some cases of phlegmonous gastritis cured by surgical treatment. The disease, therefore, occasionally presents a diagnostic problem of importance. It is a rare condition and is not often diagnosed before the abdomen is opened.

In 1919, Sundberg reviewed 215 cases. Gerster, in 1927, collected 48 additional cases. Since 1927, some 22 additional cases have appeared in the literature.

Of the four cases reported by the authors, one was the second case encountered in 4,188 autopsies at the Royal Victoria Hospital in the past twenty years. At the Montreal General Hospital there have been observed four cases, including 2 and 3 of this series, among 9,300 autopsies in the past thirty-four years. Case 4 is the only one on record at Notre Dame Hospital.

Concerning the mode of infection, the cases

fell into two classes—the secondary and the primary. Most of them belong to the latter class, in which the route of infection is most difficult or impossible to trace. Fifty cases have been reported of the secondary type, following such lesions as malignant or peptic ulcers, infected operation wounds in the stomach, or abscesses in adjacent tissues or organs.

The prognosis is extremely grave. Of all untreated cases, 92 per cent end fatally. In the three hospitals in which the authors' cases occurred, there are none on record, except those which came to autopsy.

Surgical treatment may cure some of the more accentuated cases. The operation is gastrostomy, gastro-enterostomy, jejunostomy, resection, or drainage of abscesses.

L. J. CARTER, M.D.

Acute Intestinal Obstruction, with Report of Cases (Mechanical Type). J. A. William Johnson. Jour. Am. Institute Homeop., November, 1931, XXIV, 1138-1142.

Acute intestinal obstruction may be external, internal, acquired, congenital, or traumatic. Internal obstruction occurs within the peritoneal cavity, and can be located only after opening the abdomen. External obstruction is most commonly exemplified by external hernia. Foster and Hausler maintain that there are two types of obstruction: acute simple obstruction and acute strangulation.

It is commonly accepted that the toxic element in bowel obstruction has its origin in protein decomposition in the bowel. Gatch, Trusler, and Ayers have shown that the toxic elements are caused by the bacterial action on the obstructed loop and are not absorbed by normal mucous membrane, but only after tissue necrosis occurs. Haden and Orr have further pointed out the loss of chlorides and the rise in non-protein nitrogen of the blood that occur in intestinal obstruction.

The early diagnosis of intestinal obstruction is of the greatest importance and, unfortunately, the symptoms are often recognized too late by the attending physician to be of any use in surgical treatment. The most dependable symptoms are as follows: vomiting; colicky or cramplike pains: visible, palpable, or audible peristalsis; inability to expel gas and feces, and absence of temperature. The meteorism increases as the obstruction becomes lower, and vomiting increases as the obstruction becomes higher in the intestinal tract. Acute intestinal obstruction always begins with pain and is always followed by vomiting of pathognomonic character. According to Sampson Handley, fecal vomiting should be considered as a sign of impending death rather than a sign of obstruction.

The author believes that the early use of the X-ray will help reduce the high mortality in intestinal obstruction. Roentgen examination will give the characteristic reticulated appearance of the shadow cast by the gas-distended small bowel in cases of acute obstruction. A barium enema in this type of case will do no harm and will serve as a valuable aid in diagnosis.

In treating these cases it is commonly accepted that relief of the obstruction by surgical means is the first and most important consideration. The administration of sodium chloride by hypodermoclysis or by vein is essential, even before any operation is undertaken. This treatment makes a better operative risk and should be kept up post-operatively until the patient is out of danger. It is wise, likewise, to begin the intravenous administration of glucose early and continue until the patient can take food by mouth. The author includes several case reports of obstruction of different varieties.

J. N. ANÉ, M.D.

The Relationship of Disorders of the Digestive Tract to Anemia. William B. Castle, Clark W. Heath, Maurice B. Strauss, and Wilmot C. Townsend. Jour. Am. Med. Assn., Sept. 26, 1931, XCVII, 904-907.

Anemia can presumably be produced either by an excessive loss or destruction of blood in the presence of a normally acting marrow, by a failure of the marrow to produce normal red blood cells in quality or quantity, or by a combination of these two factors.

If the food is to affect the bone marrow in some way, it is obvious that it must be absorbed from the gastro-intestinal tract. In

general, it can be shown that patients with diarrhea are more prone to develop anemia than patients without diarrhea. Liver extract administered by daily intramuscular injection to patients with pernicious anemia is many times as effective as when given by mouth. This may indicate that difficulty with the assimilation of hematopoietic substances from the gastro-intestinal tract has a bearing on the etiology of pernicious anemia.

Pernicious anemia is a deficiency disease, resulting not from a direct inadequacy of the diet but from a conditioned deficiency produced by the failure of some function of the normal stomach to take place in the stomach of a patient with pernicious anemia. This reaction in normal individuals, they believe, has to do with the manipulation of protein and leads to the absorption of a factor necessary for the maintenance of normal bone-marrow activity. In general, disturbances of the gastro-intestinal tract of various kinds may interfere with absorption or with processes necessary for the proper metabolism of food substances essential for the normal functioning of bone marrow. In this way, even in the presence of a normal diet, disturbances of the digestive tract may condition a deficiency of nutrition, in particular of substances essential for blood formation.

C. G. SUTHERLAND, M.B.(Tor.)

The "Common Mesentery" from the Surgical Point of View. A. Zaffagnini. L'Ateneo Parmense (Suppl.), 1931, III, 59-83.

We may speak of a "common mesentery" whenever in the living subject there is encountered a doubling of the parietal peritoneum, common to the small and to the proximate portions of the great intestine, and which, permitting excessive mobility to the latter, is associated in greater or lesser degree with abnormal rotation.

Thus defined, a common mesentery is a fairly rare anomaly and one which shows no predilection as regards the sexes. In the radiologic picture of the anomaly, as gathered from the examinations which have been made, the stomach, which is normally placed, is followed by the duodenum, which at times has a normal aspect, course, and fixity, but which more often is mobile and situated to the right of the median line. The small intestine is entirely dislocated in the right half of the abdomen and maintains this condition no matter what position the patient is made to assume. The ileac loop, running from right to left, enters the cecum, is generally very mobile and also very low, approximately behind the pubis. The colon is a twisted mass in the right half of the abdomen, and while the splenic angle, the descending colon, and sigma are in place, the ascending and transverse segments show numerous convolutions in the left half of the abdominal cavity, giving thus the impression of an abnormally long distention of the transverse. All the portions of the colon in front of the splenic angle are very mobile, so that the clysma in distending the colon may expel portions of it into the half of the abdomen.

The author studied five cases of common mesentery, clinically and radiologically, only one of which came to operation, with a doubtful diagnosis fluctuating between appendicitis and peritoneal tuberculosis. Knowledge of the condition, he concludes, is of genuine importance to the surgeon, not only because of the complications to which it may give rise (volvulus, invagination, etc.), but also because of the morbid conditions frequently associated with it (appendicitis, cholecystitis, gastroduodenal ulcer, etc.). These conditions, due to the presence of the congenital malformation, assume a graver course, probably because the latter creates a *locus minoris resistentiæ*.

W. W. WHITELOCK, Ph.D.

Entero-biliary Anastomosis, with Special Reference to Cholecystogastrostomy. A. Zaffagnini. L'Ateneo Parmense (Suppl.), 1931, III, 324-355.

After passing in review the various experimental stages through which the problem of entero-biliary anastomosis has passed, especially as regards cholecystogastrostomy, the author reports five cases which were subjected to this operation. There was radiologic control of three of the cases not less than twenty months after operation. He concludes that

cholecystogastrostomy, although primarily an operation of necessity, is nevertheless also valuable in cases susceptible to treatment (chronic cephalo-pancreatitis, for example), provided that they fulfill the requirements of a small stoma, and are permeable and as continent as possible, as shown by the radiographs in two of the observations. A large stoma, as seen in one of the observations, may give rise to dilatations by way of the biliary channels, with the danger of retrograde infection of the same.

From this it follows, other things being equal, and given the greater septic content which forms gradually in anastomosis with the involved segments of the intestine, that cholecystogastrostomy offers a greater guaranty of sterility and from this point of view shows its superiority to other procedures.

W. W. WHITELOCK, Ph.D.

A Case of Ileo-ceco-colic Invagination. Guido Piccinino. Archivio di Radiologia, May-June, 1931, VII, 480-489.

The author reports a case in which there were present all the radiological signs of ileo-ceco-colic invagination, which he gives in detail. At operation there was found no invagination but an adenocarcinoma of the cecum. He advises great caution in elaborating theories of the causation of this lesion, and, in making a diagnosis of it, he advises examination with barium given by mouth and by enema in order to eliminate the possibility that a tumor causes the invagination.

E. T. LEDDY, M.D.

Improved Method for Roentgen Examination of the Colon. P. C. Schnoebelen. Jour. Mo. Med. Assn., November, 1931, XXVIII, 539, 540.

This method consists of the introduction of 8 ounces of barium sulphate suspension into the rectum, the first film being made in five minutes. After part of the injected solution is expelled, a second film is made. Then all of the suspension possible is expelled and a third film made. Normal behavior is for all the barium suspension to remain in the pouch for the first film and to be entirely expelled as shown by the third film. Rectal constipation is inability to empty the pouch. If the barium leaves the pouch and passes through the sigmoid, abnormality is present. The barium will ascend to an obstruction and outline its distal surface; it will also outline the narrowed canal of a partial obstruction. The fluoroscopic examination is made and correlated with the film findings.

W. W. WATKINS, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

Congenital Bilateral Uretero-vesical Junction Stricture in Infants and Children. Meredith F. Campbell. Jour. Urol., October, 1931, XXVI, 529-546.

Congenital ureteral strictures occur in approximately 1 per cent of all individuals, are found most often at the uretero-vesical or uretero-pelvic junctions, and may be multiple as well as bilateral. When stricture is bilateral, the ultimate development of bilateral renal infection is inevitable and this, together with the symptoms caused by renal insufficiency, constitutes the clinical picture. This article is concerned only with bilateral congenital uretero-vesical junction stricture. The diagnosis is easily made by urologic examination. While removal of the obstruction is the usual indicated treatment, occasionally nephrectomy is demanded. The author reports on fifteen cases of this lesion. The ages of the clinical cases vary from two months to eleven years; the four autopsy cases included ranged from stillbirth to six months.

The embryologic etiology of congenital ureteral stricture is unknown. Apparently the incidence is higher in females. The micropathology of the stricture varies depending upon the amount of fibrous tissue and the presence or absence of inflammation. There is no evidence to indicate that localized muscular hypertrophy is the cause of the ureteral atresia in these cases. The changes in the upper urinary tract are quite the same, irrespective of the character of the ureteral blockade. The ureters and pelvis are dilated; bilateral hy-

dronephrosis may be extreme. The parenchyma shows compression nephritis and, usually, infection. If the child lives, urinary infection eventually occurs in all these cases. With the advent of infection, the upper tract pathologic process is intensified, and with advancing bilateral renal damage the signs and symptoms of uremia or urinary sepsis occur.

The late results of urinary back pressure plus infection are found in the elongated, angulated, tortuous, atonic, scarred ureters and in the thinned, sclerosed, and infiltrated renal tissue.

The clinical picture is the summation of symptoms due to infection and obstruction. Of the objective symptoms, persistent pyuria and the indication for urologic examination are outstanding.

Commonly accompanying pyuria are gastrointestinal upsets, low-grade fever, anemia, malaise, loss of weight or failure to gain, and pain due to the hydronephrotic distention. Secondary symptoms due to inflammation of the vesical outlet may be present. Marked diminution of renal function presents the usual train of uremic symptoms.

Urologic examination should include urinalysis, blood chemistry, two-hour phenolsulphonphthalein test, plain roentgenogram of the urinary tract, cystogram, cystoscopy, ureteral catheterization, divided renal function tests and, usually, pyelography.

In bilateral ureteral vesical junction stricture two findings are characteristic: (1) Difficulty in or impossibility of passing No. 4 F catheter into the ureters until the second or third examination. Upon withdrawing the catheter there is tightening of the ureter and a grasping of the catheter similar to that which occurs in urethral stricture upon the passage of a sound. Having introduced the catheter, a steady ureteral drip, characteristic of hydronephrosis, is obtained. (2) The pyelogram reveals a dilated ureter beginning in the strictured area and terminating in a hydronephrotic renal pelvis. Intravenous pyelography has not served as efficiently as the retrograde method in this type of cases.

Eradication of the obstruction is the treatment. In six of the patients gradual catheter dilatation was utilized. In the author's experience these strictures recontract rather rapidly. While marked diminution in pyuria and infection have consistently followed this treatment, in no instance has there been a bacteriologic cure.

Failing to obtain satisfactory dilatation by cystoscopic methods, open operation (transvesical ureteral meatotomy and stricture section) may be resorted to. In extremely ill patients with low renal function, preliminary bilateral ureterostomy drainage is indicated, followed by the necessary surgical measures after the renal function has been sufficiently restored. Unilateral renal damage and infection may be so extensive as to require nephrectomy. Occasionally resection and transplantation of the dilated atonic ureter may be necessary, although this is productive of ureteral regurgitation.

This study serves to re-emphasize the importance of complete urologic examination in children when pyuria—usually diagnosed as chronic pyelitis—exists. While operative treatment cannot always offer a complete cure, surgical results exceed those obtained by any other method. Medical therapy alone is inadequate; with continued back-pressure, renal destruction and uremic death may be anticipated.

A liberal number of roentgenograms and illustrations of this pathologic condition accompany the article.

DAVIS H. PARDOLL, M.D.

Intravenous Pyelography with Skiodan: A Brief Clinical Report. David W. MacKenzie and Max Ratner. Canadian Med. Assn. Jour., August, 1931, XXV, 172-174.

The introduction of uroselectan for intravenous pyelography by Swick and von Lichtenberg has proved to be an invaluable aid in the diagnosis of genito-urinary disease. The drug is a popular one and is being used extensively all over the world. Since April, 1931, the authors have been using a new drug, skiodan, which has proven a safe and reliable medium.

The drug is a very efficient diuretic and the rate of excretion is high. In spite of this rapid excretion the drug does not throw a

heavy load on the kidneys. The urine remains normal and the kidneys of laboratory animals do not show any pathologic lesions other than at times a slight cloudy swelling. The iodine content of skiodan is high, 52 per cent, but the iodine is in firm combination and is not set free in the urine.

Little preliminary preparation of the patient is necessary. A good cathartic is given the night before, followed by an enema in the morning. Twenty or twenty-five grams of the drug are dissolved in 100 c.c. of double distilled water. The solution is then filtered twice and is sterilized in an autoclave for 20 minutes at 15 pounds pressure. The solution is then cooled to body temperature and is injected into the median cephalic or basilic vein. There have not been any general reactions whatsoever, and, provided that all the solution went into the vein, there were no local reactions.

The first film is taken ten minutes after the injection, and one every 15 minutes for the next hour. From then on, films are taken depending on the excretion of the drug.

The only contra-indication to the use of the drug is severe impairment of the function of the kidneys.

A number of excellent reproductions of films showing such conditions as hydronephrosis, hydro-ureter, destroyed kidney, accompany the contribution of the authors.

L. J. CARTER, M.D.

Roentgen Diagnosis in Intravenous Pyelography. Jesse J. Peters. Med. Bull. Veterans' Administration, October, 1931, VII, 918-921.

The author reviews the history of intravenous pyelography and discusses the preparation and use of uroselectan in the study of pathologic conditions of the urinary tract. Intravenous pyelography offers a simple, painless method of examining the kidney pelves, ureters, and bladder, radiographically producing urographs of diagnostic quality. This method does not replace retrograde pyelography, but should serve as an aid to determine function in surgical kidneys. In those cases, however, in which cystoscopy is difficult or impossible the intravenous method will be found most useful. It offers valuable aid to the following, heretofore denied this important diagnostic aid: (1) Infants and children; (2) debilitated adults; (3) urethral stricture cases; (4) cases with deformities; (5) certain malignant cases. It is the method of choice in the absence of a competent urologist.

Hydronephrosis is probably the most commonly met pathologic change in the kidney. In those cases a careful study of the urographic findings should be made. Mechanical obstruction high in the ureter shows the pelvis greatly enlarged, with a flattening of the renal papillæ. On the other hand, obstructions lower in the ureter dilate the ureter and pelvis but very frequently do not involve the minor calices. Dilatations due to infections are generally less extensive than those of a purely mechanical nature and are more prone to distortions and irregularities in contour, due to the reaction of the renal epithelium.

J. N. ANÉ, M.D.

Ureterography in Some Blennorrhagic Sequelæ and in "False Passages." L. Brunetti. Archivio di Radiologia, May-June, 1931, VII, 445-465.

The author reports some ureterographic studies in a score of patients with sequelæ of gonorrhea. In his discussion of the normal and pathologic anatomy of the urethra, he advances some of his own views on the value of X-ray examination of it. In two cases of traumatic false passage he demonstrated its location and extent by injection of lithium iodide. An extensive bibliography on radiography of the urethra is appended.

E. T. LEDDY, M.D.

Cortical Adrenal Tumor. Hunter, McMillan, Boyd, and Cameron. Canadian Med. Assn. Jour., August, 1931, XXV, 188-193.

Hunter reported, at a clinical conference, the case of a female, aged 30, admitted to the Winnipeg General Hospital, complaining of weakness, loss of weight, pain in the back, amenorrhea, shortness of breath, and swelling of the feet and legs. She had been a patient in the outdoor department about a year and a

half previously, when a tentative diagnosis of chronic glomerular nephritis was made.

He indicates that the diagnosis should be obvious from a study of the clinical history and an ordinary physical examination. This is emphasized in view of the modern tendency to substitute laboratory diagnosis for the safer but more time-consuming bed-side examination. When menstruation disappears, when hair of the masculine type of distribution develops profusely in a young woman of buffalo-like disproportion of shoulder and buttock, who exhibits a large tumor in the renal region and a hypertrophied clitoris, tumor of the adrenal cortex is the probable diagnosis.

McMillan gave the X-ray findings as follows: The right diaphragm is elevated, being one and one-half interspaces higher than the left. It has the normal curve, which would suggest that the displacement is due to some intra-abdominal pressure. There is a clear-cut, circular, opaque area in the lower part of the right chest, just above the diaphragm, which has very much the appearance of a metastatic lesion from a malignant kidney. There is marked decalcification of the bodies of the last dorsal and all the lumbar vertebræ. The bodies of these vertebræ are more or less collapsed, the third being the least deformed. The left kidney shadow is distinctly seen, but the right is not. There is a small circular shadow superimposed on the ninth rib posteriorly, and well out from the midline. A pyelogram made on the right side shows the pelvis and calices to be well visualized. The kidney is apparently displaced downward and the upper pole rotated outward. The upper calyx shows some deformity.

Boyd reported on the pathologic examination of the tumor removed from the vaginal wall, which resembled tumors of the adrenal cortex.

Cameron discussed tumors of the adrenal cortex and their effect in producing the sex changes noted.

L. J. CARTER, M.D.

Metastatic Growths in the Ureter: A Report of Three Cases and a Brief Review of the Literature. David W. MacKenzie and Max Ratner. Canadian Med. Assn. Jour., September, 1931, XXV, 265-270.

Pathologic lesions that are of rare occurrence, and usually diagnosed at the autopsy examination or in the operating room, always stimulate interest and discussion. Metastatic growths of the ureter belong to this class, and lately the authors encountered such a condition. They review the literature and collect other similar cases that have been met with at the Royal Victoria Hospital.

Newgrowths of the ureter, whether primary or metastatic, are extremely rare occurrences; the former appears to be the commoner of the two. Although only 59 cases of primary growths of the ureter are reported, yet an appreciable amount of literature has been written on the subject. On the other hand, very little has been published on metastatic growths of that organ. Up to December, 1930, only eight authentic cases could be found in the literature.

It is of extreme importance to emphasize that under the heading of metastatic growths of the ureter are included only those lesions that have been proved definitely to be the result of metastasis conveyed to the ureter by lymphatics or blood vessels. Secondary growths of the ureter, due to direct extension of tumors of adjacent organs, such as the uterus, bladder, or kidneys, are not true metastases, and are not included, therefore, in this class. Moreover, in order to prove that a secondary growth is a true metastatic one, malignant cells must be demonstrated in the perivascular lymphatic spaces or blood vessels of the ureter.

The first authentic case of a metastatic growth of the ureter was reported by Giordano and Bumpus, in 1922. This was a carcinoma of the prostate which had metastasized to the left ureter, left renal pelvis, lungs, and left kidney.

In 1925, Carson added three more cases to the literature. The first was that of a man with a carcinoma of the bladder which metastasized to both ureters, prostate, mesenteric lymph nodes, lumbar vertebræ, and liver. The second had an adenoma of the prostate with metastasis to the right ureter, bladder, seminal

vesicles, vasa, right kidney, lungs, fifth lumbar vertebra, and lymph nodes. The third was a squamous-cell carcinoma of the cervix which metastasized to the right ureter, liver, and mesenteric lymph glands. In 1927, Carson reported two additional cases. The first was a carcinoma of the prostate which metastasized to the right ureter, bladder, seminal vesicles, lumbar vertebræ, and mesenteric lymph nodes. The second was a carcinoma of the prostate which metastasized to the right ureter, bladder, seminal vesicles, right kidney, pelvis, lungs, and lymph nodes.

Rathbun, in 1929, described a single case. The patient, a male, had metastasis in the left ureter, secondary to scirrhous carcinoma of the left breast, which had been removed three years previously.

The authors carefully reviewed all the cases with lesions of the ureter that have been met with in the Departments of Urology and Pathology at the Royal Victoria Hospital, Montreal. They found three cases of metastatic growths, thus making a total of eleven authentic cases.

Of the three cases found, one was in a female and two in males. The female was 34 years of age, and the males 45 and 61. Both the male cases came to autopsy, and the diagnosis was made on the postmortem table. The female patient is still alive. The diagnosis in her case was made at operation. The first patient came into the hospital complaining of shortness of breath, palpitation, swelling of the legs, cough, bloody expectoration, and slight nocturnal urinary frequency. The symptoms had been of one year's duration. The clinical diagnosis was chronic nephritis, aortitis, and chronic myocarditis, with decompensation. The patient died 48 hours after admission to the hospital. The postmortem findings were adenocarcinoma of the prostate, with metastases in the ureters, lungs, and lymph glands, bilateral hydronephrosis, hypertrophy of the heart, arteriosclerosis, dilatation of the first part of the aorta. Although the patient died from carcinoma of the prostate, with multiple metastases, yet the clinical picture was that of cardiac failure and renal insufficiency.

The second case was one of carcinoma of the stomach. There were no symptoms referable to the urinary tract, yet the postmortem examination revealed metastatic growths in the right ureter.

The third case was discovered on the operating table. A carcinoma of the cervix had been treated by radium a year previously, with apparently good results. One year after treatment the patient began to complain of severe pain in the left loin, radiating down and forward, frequency of urination, anorexia, and loss of weight. A clinical diagnosis was made of an obstructed ureter, with a left hydronephrosis. The patient was operated upon and a nephrectomy and partial left ureterectomy were done. The anatomical diagnosis was carcinoma of the ureter secondary to carcinoma of the cervix.

In summarizing their contribution, the authors note that the diagnosis of a newgrowth of the ureter, whether primary or secondary, is made almost always at operation or on the autopsy table. There are no signs or symptoms which are pathognomonic, and the condition is rarely considered. The outstanding symptom is pain. This may be represented by a dull steady ache on one or the other side, or may simulate a severe renal or ureteral colic. Hematuria is a variable symptom. In primary growths it occurs at one time or another during the course of the disease, and may be profuse or very scanty. In metastatic growths, on the other hand, hematuria will not occur unless the growth has encroached on the lumen of the ureter. Frequency, urgency, and dysuria are occasionally complained of, and usually result from a secondary infected hydronephrosis and hydro-ureter. Cystoscopy gives the most information.

L. J. CARTER, M.D.

Foreign Body in the Abdomen as a Result of Attempt at Abortion Localized by X-ray. Dino Agati. Archivio di Radiologia, May-June, 1931, VII, 466-472.

This is a case report of attempted abortion by means of a catheter introduced into the uterus. The uterine wall was ruptured, and there was found on X-ray examination an

opaque catheter—a Gregory No. 10—lying almost completely inside the peritoneal cavity. Following laparotomy and removal of the foreign body, the patient made a smooth convalescence. The author emphasizes the importance of X-ray examination in cases with obscure objective signs and subjective symptoms, as in this patient.

E. T. LEDDY, M.D.

The Effect of Peritoneal Adhesions upon the Urinary Tract. Frank S. Patch and Merle D. Evans. Canadian Med. Assn. Jour., October, 1931, XXV, 399-401.

Obstructions of any part of the urinary tract by lesions outside it constitute an interesting chapter in urology. Examples of this are constantly to be found in connection with the genital organs of the female, as displacements and tumors of the uterus, inflammatory deposits in the parametrium affecting the bladder, and, in both sexes, malignant metastatic growths in the pelvis, profoundly affecting the ureters and kidneys. Urologic textbooks only occasionally deal with this type of lesion. We have not observed any reference to the effect of peritoneal adhesions in producing ureteral obstruction. It appears to us, however, that the lesion is much more common than this would indicate, and that the possibility of its occurrence should be borne in mind by urologists in cases of hydronephrosis in which no other etiologic factor can be found. Three cases of this sort have been observed in the urologic service of the Montreal General Hospital, and are here reported in detail.

The three cases differ markedly in various respects. The first was an accidental autopsy finding which furnished definite proof that the lesion produced almost complete destruction of the kidney above the obstruction. The other cases were clinical observations, with markedly contrasted therapy, in one case radical, in the other conservative.

Case 1. A married woman, aged 67, was admitted with a history of frequency of micturition and incontinence of urine. She was found to have residual urine of 2,230 cubic centimeters. The specific gravity of the urine was 1,020, reaction alkaline, and it contained albumin, pus, and red blood cells. X-ray examination of the genito-urinary tract was negative. Cystoscopy showed the capacity of the bladder to be reduced. The bladder wall was friable and covered with an adherent slough, gangrenous in character. The ureteral orifices could not be seen. Cystostomy was done and drainage was effected by a Freyer tube. There was slight temporary improvement, followed by a lapse into unconsciousness and death. Autopsy showed a gangrenous cystitis. The left ureter and kidney were normal; the right ureter and kidney were greatly dilated and filled with a dark, foul-smelling material. The kidney cortex was much inflamed. The point of interest, and the one accounting for the right pyoureter and right pyo-nephrosis, was found in several pelvic adhesions, one of which ran from the postero-lateral border of the right broad ligament to the peritoneum just beyond the sacro-iliac synchondrosis. This band crossed the ureter close to the bladder and tightly compressed it, leaving a distinct furrow below which the ureter was of normal caliber; immediately above it the ureter was widely dilated.

Case 2. A man aged 54 had suffered repeated attacks of pain in the left lower quadrant of the abdomen. These attacks had been present off and on since an abdominal operation in 1919, for a supposed abdominal tumor. In 1923, the abdomen was opened for adhesions, but without relief. The pains were colicky in nature and accompanied by nausea and a desire to urinate, which act gave relief. Cystoscopy showed a smaller left ureteral orifice, and there was a suggestion of ureteral narrowing but no hydronephrosis. The ureter was dilated to No. 11 Fr. on several occasions, without relief. The abdomen was opened and numerous adhesions in the left lower quadrant were separated with difficulty. The patient remained well for a year, when the pains again returned. Pyelography showed a normal kidney. The abdomen was again opened and dense adhesions between the bowels, the pelvic walls, and the bladder were found impossible of removal. The attacks continuing, it was seen that nothing could be done but remove the apparently normal left kidney. This was

done. Examination of the removed kidney by the pathologist revealed nothing more than a slightly dilated pelvis, and a small scar in the cortex which suggested a healed inflammation. The patient has been perfectly well ever since.

Case 3. A woman of 57 was admitted suffering from attacks of pain in the left lower quadrant, associated with frequency of urination. Cystoscopy showed a normal condition of the bladder and ureters. The diagnosis was peritoneal adhesions, causing intermittent hydronephrosis and pyelonephritis. A laparotomy was advised but the patient did not consent. Six months later the patient returned with the condition unimproved. Cystoscopy again was normal for urogram of the left kidney and ureter. At operation the sigmoid was found adherent to the base of the broad ligament, posteriorly. The lesions were removed and the uterus suspended to the anterior abdominal wall. The ureter was palpated and appeared to be normal. The patient has been perfectly well in the two years that have elapsed since the operation.

L. J. CARTER, M.D.

Criteria of Interpretation and a Critical Evaluation of Intravenous Pyelography. Mario Luigi Asti. Archivio di Radiologia, May-June, 1931, VII, 589-604.

The author reports some studies carried out with uroselectan and abrodil. He points out the safety and advantages of this examination, but feels that incorrect interpretation of the findings may lead to grave diagnostic errors. He shows that ascending pyelography is still a method of the greatest importance.

E. T. LEDDY, M.D.

A Case of Bilateral Hydronephrosis, Pyelonephritis, and Kinked Ureters, Treated by Bilateral Nephrostomy, Demonstrating the Recovery Phase in the Pathological Physiology of the Ureter. Channing S. Swan. Urol. and Cutan. Rev., November, 1931, XXXV, 713-715.

It has been demonstrated that as a result of partial obstruction of the ureter hypertrophy and hyperplasia of the musculature, elongation, tortuosity, and dilatation of the ureter developed. A similar reaction is noted in pregnancy, as a result of pressure on the ureter by the enlarging uterus. Crabtree demonstrated that in the average normal case the ureter returned to normal in three months postpartum. Quinby stated further that mere infection of the ureter without pregnancy or obstruction would produce similar changes. He also believed that the ureter would return to normal after the infection had been cleared up, if there was not too severe a degree of peri-ureteritis fixing the organ in its snake-like position. From one to two years was considered the recovery time, as demonstrated by the X-ray.

The author's patient, a woman 52 years of age, and the mother of thirteen children, complained of pain of six months' duration in the left kidney region. When first seen she was vomiting, and there was tenderness and the question of a mass in the left kidney region. A pyelo-ureterogram showed a kinked left ureter and a left hydronephrosis. The temperature, pulse, and respirations were elevated. The day after admission she complained of pain in the right kidney region. Pyelography revealed a tortuous kinked ureter and a mild hydronephrosis on the right, similar, but less marked, to that on the left. About one week subsequent to admission a left nephrostomy was performed under local anesthesia, twenty days later nephrostomy being done on the right kidney. The right nephrostomy was permitted to heal in ten days, but the left side was kept open.

Three months after her original entry she returned for observation. Pyelo-ureterograms revealed normal ureters and practically normal renal pelves. The left nephrostomy was then allowed to heal. Further observations showed complete recovery from the urologic condition. The author believes that this case demonstrates the power of the ureter to recover anatomically and physiologically from the elongation and tortuosities which come with infection.

J. N. ANÉ, M.D.

The Radiologic Findings in Cystic Dilatation of the Lower End of the Ureter as

Shown by Descending Pyelography. Guerrino Lenarduzzi. Archivio di Radiologia, May-June, 1931, VII, 580-588.

The author thinks that descending pyelography gives a complete pathognomonic picture of cystic dilatation of the ureter, because it gives natural filling of both the ureter and the bladder and so brings to light the real morphology of the two organs. Therefore, descending pyelography is superior to ascending pyelography in the study of this lesion.

E. T. LEDDY, M.D.

Traumatic Rupture of the Urinary Bladder Due to Fracture of the Pelvis. Joseph A. Lazarus. Urol. and Cutan. Rev., December, 1931, XXXV, 761-764.

Traumatic rupture of the urinary bladder results more frequently from external violence than internal forces, but both types of injury may serve as etiologic agents. Intra-peritoneal ruptures are more frequently encountered than the extra-peritoneal types. Since the traumatic force is most frequently directed to the lower abdominal wall, the rupture usually occurs in the upper median part of the bladder surface, a portion of the bladder usually covered by peritoneum. The entire thickness of the vesical wall is usually involved in a laceration of this viscus.

Extravasation of urine and infection are the most important complications of rupture of the urinary bladder. Hemorrhage rarely occurs and, when present, is not sufficient to endanger the life of the patient. In the intraperitoneal type of rupture the results attending the extravasation depend mostly upon the character of the urine. Sterile urine leads to peritoneal irritation and peritonitis as a late complication. Diffuse peritonitis is generally the rule in cases of intra-peritoneal rupture of an infected bladder. In cases of extraperitoneal rupture, the tissues affected by the extravasation depend directly upon the position of the laceration. Cellulitis, with abscess formation, may result from superimposed infection of the extravasated urine.

Immediately following rupture of the bladder the patient is usually in shock. Pain, tenderness, hematuria, toxemia, and inability to void are characteristic symptoms in all cases of vesical laceration. Pain is present in all cases, accompanied by vomiting and distention in those cases in which the extravasation is intra-peritoneal. Fever occurs with the onset of infection. In untreated cases intoxication results from absorption and infection, frequently terminating in uremia and death.

In some cases the diagnosis may be made from the history alone. Vaughn and Rudnick advise the injection of a small amount of air into the bladder while the patient is under the fluoroscope. The association of rupture of the bladder and fracture of the pelvis is always serious because of the possibility of osteomyelitis.

The treatment of rupture of the urinary bladder is always surgical and consists of the eradication of the sinus tracts and repair of the rent itself. The average mortality resulting from surgical treatment of intraperitoneal rupture of the bladder, as compiled by Young, from various clinics, is 51 per cent.

The author presents the case of a female child, two and one-half years old, who presented a fistulous urinary tract opening on the upper and inner aspect of the right thigh. There was likewise a free escape of urine through the vagina. Six months previously the patient had sustained a fracture of the pelvis as the result of an accident. At the time of examination by the author, a cystogram, taken after the injection of opaque medium through the sinus of the right thigh, outlined the fistulous tract extending along the right pubic bone into the bladder. The bladder appeared thickened and trabeculated. At operation the bladder wall was found greatly thickened and the vesical cavity contained a large quantity of necrotic and calcareous material. After surgical treatment the patient made an uneventful recovery.

J. N. ANÉ, M.D.

Pyelography by Descending Route. Carlos Heuser. La Semana Méd., Sept. 10, 1931, XXXVIII, 851-855.

Since many reports have come out in the literature concerning poor results obtained from intravenous pyelography, particularly in cases in which uroselectan and abrodil are

used, the author takes great pains in this article to describe the technical points which must be followed in order to obtain good results. He presents two cases of dilatation of the pelvis and ureters, due to pressure (pregnancy) in which resort was had to intravenous pyelography.

N. G. GONZALEZ, M.D.

Renal Carbuncle. Albert R. Fritz and Leo S. Drexler. Urol. and Cutan. Rev., November, 1931, XXXV, 703-705.

Carbuncle of the kidney, described by Israel, in 1901, is considered rather rare, as a recent review of the literature by Moore revealed only 42 cases. The authors report an additional case and discuss the etiology, pathology, symptomatology, diagnosis, and treatment of renal carbuncle.

The patient, a boy, 18 years of age, complaining of pain in the right lumbar region associated with fever and general malaise, was admitted for hospitalization. His urine was persistently negative for pus or blood, and there were no urinary symptoms. History disclosed that the patient had been annoyed by pimples over his neck and back, which had subsided six weeks before the onset of the present illness. Physical examination revealed an acutely ill, emaciated individual, whose temperature was 99.2, pulse 86, and respiration 20. The abdomen was somewhat distended, but no masses were palpable. Cystoscopic examination was negative except for slight obstruction to the ureteral catheter high up on the right. Indigo carmine, injected intravenously, returned in three minutes on the left and in seven minutes on the right. Roentgenologic examination showed an enlarged right kidney. Pyelography revealed a moderate degree of pyelectasis on the right. The upper calyx was elongated and a large cystic dilatation, apparently communicating with the inferior major calyx, was noted and filled with the injected sodium iodide. The culture of urine from the right kidney was reported as *B. coli.* The blood examination showed 26,600 leukocytes, with 80 per cent polymorphonuclear cells. A diagnosis of renal carbuncle was made from the history and roentgenologic findings, and the patient was operated on. The abscess was found well walled off, of considerable size, and bearing the typical appearance of a carbuncle as met with in other portions of the body. Nephrectomy was performed and the patient's convalescence was uneventful.

This condition was found to attack men more frequently than women, and the age limits in the reported cases range from 10 to 55 years. The original focus of the *Staphylococcus aureus,* the usual invader, is often considered trivial. Trauma is believed to be an important predisposing factor. The pathologic picture is usually confined to the cortex, although in some cases it may rupture into the capsule and produce a perinephritic abscess, or, rarely, it may involve the remainder of the kidney and drain through the pelvis and the ureter.

The onset is usually insidious with malaise, loss of appetite, and an intermittent fever. Leukocytosis, with counts from 10,000 to 25,000, is the rule. Pain, nausea, and vomiting are also encountered in some cases. The authors believe that the history of the case is the most important factor in the diagnosis. However, differentiation from an acute embolic metastatic kidney is difficult. Deformities in the renal pelvis and distention of the calices, as observed by pyelography, have been reported by Moore, Dick, and Horn. The distention of the pelvis, due to the pressure of the abscess, often suggests a renal neoplasm.

In the treatment of renal carbuncle, nephrectomy is believed to be the treatment of choice. In cases in which the carbuncle is small, resection has been recommended. Moore reported a case in which complete cure was obtained by the intravenous administration of mercurochrome.

J. N. ANÉ, M.D.

The Lateral Pyelogram: A Neglected Procedure in the Diagnosis of Various Abdominal Conditions. H. O. Mertz. Jour. Indiana St. Med. Assn., October 15, 1931, XXIV, 537-541.

The technic of making a lateral pyelogram should be studied and worked out by each

cystoscopist and roentgenologist. It will necessarily vary somewhat with each operator. The usual cystoscopic table may be used, the side of the patient to be injected being next to the film. The position must be exactly lateral. An anteroposterior pyelogram is first made and studied, the patient's position being changed if a lateral view seems advisable. Normally the shadow of the pelvis lies behind the second lumbar vertebra. Congenital changes in the kidney and ureter, the orienting of densities suspected of being calculi, tumors in the kidney region, and many other conditions find an easier solution when a lateral pyelogram is taken in addition to the usual anteroposterior view.

W. W. WATKINS, M.D.

Intravenous Pyelography. Luigi Turano. Archivio di Radiologia, May-June, 1931, VII, 605-626.

The author reviews 150 cases studied by him and brings out the advantages and limitations of the method in the study of various urologic conditions.

E. T. LEDDY, M.D.

Diseases of the Biliary Tract: Clinical and Surgical Aspects. Claude F. Dixon. Calif. and West. Med., July, 1931, XXXV, 1-5.

The author comments on the literature and pathology of the diseases of the biliary tract. He gives the various types and classifies these diseases, according to Judd and McIndoe, as follows: (1) Acute cholecystitis; (2) metabolic cholecystic disease, with or without stones, and (3) clinical or functional cholecystic disease.

Under metabolic cholecystic disease, with or without stones, is the so-called "strawberry gall bladder." In this the gall bladder may function normally and, unless the stone obstructs the cystic duct, there may be no symptoms.

In the third group there may be typical symptoms yet no evidence of disease is found —either microscopically or grossly; yet relief is often had after removal of the gall bladder. Cholecystography has been found a great aid in the diagnosis of disease of the gall bladder. The functional test should be used in corroboration with the clinical findings. The most characteristic symptom of a diseased gall bladder is pain, and when this is present, removal of the organ gives permanent relief in the majority of cases.

FRANCIS B. SHELDON, M.D.

The Diagnostic Value of Intravenous Urography. Bruno Bellucci. Archivio di Radiologia, May-June, 1931, VII, 651-661.

The author thinks that the greatest value of the method is in those cases in which the ascending method is contra-indicated or those in which its evidence needs supplementation or confirmation.

E. T. LEDDY, M.D.

The Rôle of the Ureter in Lesions of the Upper Urinary Tract. Solomon I. Movitt. Urol. and Cutan. Rev., October, 1931, XXXV, 647-649.

The author is of the opinion that pathologic conditions of the ureter occur more commonly than the number of cases reported would lead one to believe. From an anatomic standpoint, the kidney pelvis is not an organ which at times fills up and at times empties itself. It should be considered as a link between the kidney and the urine-conveying tract. Hyrtl expressed the view that anatomically the renal pelvis is just the initial part of the ureter, which forms only an unnoticeable continuation of the pelvis.

The points of interest in the physiology of the ureter, as mentioned by the author, are as follows: (1) It is distensible; (2) it has natural points of constriction often accentuated under pathologic conditions; (3) it has a mechanism at the ureteral orifice which prevents regurgitation from the bladder. Winslow and O'Connor, however, have demonstrated that in pathologic conditions reflux of urine can occur in man. Hunner pointed out the significance of the ureter in the urinary system, and he also contended that focal infection should be considered as an etiologic agent in ureteritis and ureteral strictures. The im-

portance of congenital strictures of the ureter should be remembered also.

Ureteral conditions may give rise to many symptoms in organs quite unrelated to the genito-urinary tract. A number of patients, especially women, have persistent and obscure gastro-intestinal symptoms with negative gastric analyses. Many of these patients are operated upon for various gastro-intestinal conditions, and experience no relief after the operation. Usually after considerable study, evidences of hydronephrosis are found, and the patients find themselves free of symptoms after dilatation of the involved ureter.

While the majority of ureteral calculi have their origin in the kidney, the author believes that constriction and obstruction of the ureter offer very favorable conditions for the production of calculi directly at the site of the lesion. Ureteral fibrosis may precede or cause the stone, or may be extended by a stone descending from the kidneys, and arrested by a pre-existing soft stricture.

The author concludes that all vague abdominal pain, gastro-intestinal symptoms, and obstinate backache should be carefully considered and studied by the internist, the pathologist, the roentgenologist and the urologist, all working together in mutual co-operation.

J. N. Ané, M.D.

Hydrosalpinx: Its Visualization by Hysterosalpingography. Albert Mathieu. Calif. and West. Med., August, 1931, XXXV, 73-78.

In discussing hydrosalpinx, the author depends a great deal on iodized oil and the X-ray findings for diagnosis. He discusses the various types of hydrosalpinx; namely, those with closure of the proximal end of the tube, with closure of the distal end, and with closure of both ends.

In discussing the etiology, he believes that most of these are due to gonorrheal infections. However, some of them may be due to tuberculous or pyogenic streptococcus infection. From the history it is probable that the husband has infected his wife with an attenuated gonococcus, he having thought himself cured and married prematurely. The author illustrates his article with many X-ray reproductions.

Francis B. Sheldon, M.D.

GENITO-URINARY TRACT (THERAPY)

Empyema of the Ureteral Stump. Ralph L. Dourmashkin. Jour. Urol., October, 1931, XXVI, 553-573.

The writer employs the above term to designate a collection of thick pus within a dilated ureteral stump, following incomplete ureterectomy. The persistence of pyuria may follow non-tuberculous nephrectomies in which a diseased ureter has not been carefully followed down to the bladder and excised. Omission of proper care to the infected lower end of the ureter may lead to a condition described as empyema of the ureteral stump.

Since normal ureters rarely become infected following nephrectomy, it would seem that a requisite for an empyema of a ureter to develop would be a pre-existing diseased state of this organ.

The treatment consists of adequate drainage and lavage of the infected sac. If this is found impossible because of a stricture at the lower end of the ureter, the orifice may be enlarged by fulguration, or, finally, excision of the stump must be resorted to if the preceding therapy has been found inadequate.

The paper reviews several cases which are accompanied by roentgenograms illustrating the condition.

Davis H. Pardoll, M.D.

The Prostatic Problem. John H. Cunningham. Canadian Med. Assn. Jour., October, 1931, XXV, 428-432.

In considering the prostatic problem, the most important fact to be appreciated is that the prostate itself is but the primary factor producing urinary retention. The presence of this retention influences the activity of the kidneys, and, in consequence, reflects unfavorably upon the circulation. Thus, a medical aspect develops which becomes the most important part of the picture, and surgery is but the means of improving it. In view of our present knowledge of the requirements for pronounc-

ing a prostatic patient fit or unfit for surgical treatment, every patient with prostatic obstruction must be viewed in terms of renal and circulatory impairment, and should be given the advantages of most careful clinical and laboratory study to determine the best course to pursue.

In order to give the general average of the prostatic patient, the author looked over his last 400 cases operated upon. The age varied from forty-four to eighty-nine years, and the greatest number of cases occurred between the ages of sixty and seventy. Associated defects were discovered as follows: Renal, over 90 per cent; circulatory, over 75 per cent; respiratory, over 20 per cent; nervous system, over 25 per cent.

This great preponderance of renal and circulatory defects renders the determination of the condition of the kidneys and circulatory organs the most important feature of preoperative study. Renal impairment will depend chiefly on the degree of the back pressure. This produces dilatation not only of the ureters but also of the kidney pelves and calices, and a thinning of the renal cortex, whereby the secretory power of the kidneys is decreased. Infection superimposed upon these mechanical degenerative changes further diminishes efficiency of the kidneys. As a result of this diminished power of elimination of the kidneys, an increased burden is placed upon the heart. A definite cardio-renal complex and a varying degree of toxicity develop insidiously, with an abnormal nitrogen retention, and uremia is an inevitable consequence.

The deaths from prostatectomy, in olden days, occurred mostly from uremia, occasionally from sepsis, and, rarely, from hemorrhage. The mortality to-day depends upon the same factors, but much may be accomplished by pre-operative treatment in overcoming uremia and sepsis. As a consequence, the mortality has changed from about 30 per cent, twenty years ago, to about 5 per cent at the present time.

Bladder drainage is the most important feature of pre-operative treatment, and is the means to the end of permitting the forcing of fluids and an estimation of the recuperative powers of the individual.

The author goes into the details of operative treatment for the various types of prostatic obstruction, the nature and extent of the operation depending on the nature of the obstruction and the condition of the patient.

In cancer of the prostate the malignant obstruction should be removed through the perineum, if the patient's general condition permits of operation. If it is poor, and metastases are present, permanent suprapubic drainage is more appropriate, with or without subsequent treatment by X-ray or radium. Prior to operation the tumor should receive active radium treatment to lessen the vitality of the malignant cells, because during the operation the malignant mass is usually broken into and blood spaces are opened up which form avenues for the dissemination of the disease. At the time the gland is removed, radium should be left in the prostatic region for at least 500 millicurie-hours. After recovery from the operation, radium and deep X-ray therapy should be used.

L. J. CARTER, M.D.

Excretion Urography. G. C. Burr and B. Dovitz. Jour. Michigan St. Med. Soc., August, 1931, XXX, 595-600.

Attempt is made to evaluate this procedure on the basis of the first 50 cases examined by it in the Department of Urology of the Detroit Receiving Hospital. Excretion urography is still in the process of experimentation but it has evidently come to stay, as it has its value in special cases. Dynamics of the urinary tract can be studied only by this method. It will not supplant retrograde pyelography, which was necessary in 36 out of the 50 cases examined.

The technic was to inject 40 grams of iopax in 100 c.c. of double distilled water at body temperature. The patient was prepared by being given compound licorice powder at 5 P.M. the day before examination, cleansing enemas in the morning, no breakfast, no fluids, 1/50 gr. of eserine a half hour before injection, slow injection over a period of 15 minutes, with roentgenograms made at inter-

vals of 15, 30, 60, and 90 minutes following completion of the injection.

No alarming reactions were noted, though patients complained of a variety of minor symptoms. In only 18 cases were the results entirely satisfactory. In 13 cases, the upper urinary tract was not visualized; of these, final diagnoses were normal in 5, pyelonephritis (3), kidney tumor (2), perinephritic abscess (1), and renal tuberculosis (2).

W. W. WATKINS, M.D.

Ureteral Meatotomy: A Clinical Evaluation. Neil S. Moore. Jour. Urol., October, 1931, XXVI, 519-528.

From a clinical and radiographic study of about seventy-five cases on which ureteral meatotomy had been performed, covering a period of seven years, the author feels justified in drawing the following conclusions:

(1) The operation, though comparatively minor, is technical and deserves just consideration.

(2) When properly applied, the high frequency meatome is effectual and safe. It is possible to continue work higher up the ureter at the same sitting. There should be no alarming complications.

(3) There has not been any stricture formation following the operation in any of the cases observed.

(4) In a clinical and radiographic study of a series of cases, and symptoms or signs of ureteral regurgitation, at any time following the operation, were absent.

(5) A number of cases have been found in which the ureteral opening was amply large to admit from seven to nine catheters after the passage of which there was temporary relief. The same cases have shown more permanent, if not definitely permanent, relief following a good wide incision of the opening.

The writer has devised an instrument for performing the operation and illustrations of it are contained in the article.

DAVIS H. PARDOLL, M.D.

Therapeutic Irradiation of the Ovaries. A. C. Siefert. Calif. and West. Med., October, 1931, XXXV, 290.

This paper takes up the therapeutic action of roentgen rays and of radium when directed against the ovaries of women suffering from benign gynecologic affections, as well as from diseases remote from the sexual organs *per se*, but which are influenced by the ovaries. The opinions here presented are based on personal experience with some sixty patients.

The author then takes up the general considerations, such as the effect of ovarian activity on a healthy genital tract and the body generally, and the sensitivity to radiation of the epithelial constituents of the ovary, which is exceeded only by the lymphatic tissues.

In the use of radium for menostasis not over 800 milligram-hours should be used. For permanent amenorrhea the radium intrauterine dose must be from 1,200 to 1,800 milligram-hours, or from 35 to 40 per cent of a roentgen skin dose must be absorbed by the ovary. The best time for giving the dose is the first half of the intermenstrual period. In younger women the question of post-radiation pregnancy must be considered. This possibility is discussed by the author.

Under the heading of "Special Phases" he discusses the treatment of: (1) *Benign uterine hemorrhage,* for which he prefers the roentgen ray. Good results, in his experience, measure up to a 100 per cent standard, provided the proper agent is used and an adequate dosage given. Contra-indications are: uncertainty of diagnosis regarding the benign nature of the hemorrhage, the youth of the patient, extremely neurotic individuals, and hypertension.

(2) *Painful menstruation.* Radiation menopause by means of the X-ray is justifiable if the patient has reached her fortieth year. The results in this case are very gratifying. Here the same contra-indications should be considered as given under "Benign hemorrhage."

(3) *Fibromyoma uteri.* Under this heading the question of whether the treatment should be given to the ovary or to the tumor alone is discussed. The author believes that the treatment should be directed to the ovaries. Here he gives as contra-indications: the youth of the patient, acute and serious pressure symptoms, degeneration of myomas, pedunculated myomas, and infection, if acute. Sar-

comatous degeneration and carcinoma of the body of the uterus, in the author's opinion, are not contra-indications; for here pre-operative irradiation would be a distinct benefit. These two conditions, associated with uterine fibromyomas, are, however, rather rare complications.

(4) *Chronic infections of the uterus and adnexa* may be favorably influenced by roentgen-ray therapy. The guiding principle here is the observation that the periodic congestion of the pelvic organs, incident to menstruation, adversely affects the infectious process. Therefore, temporary or permanent menostasis may be accomplished.

(5) *Diseases outside the genital tract.* Carcinoma of the breast therapy in young women is ofttimes helped by stopping the menstrual function. Also, in toxic goiter, the cessation of the menstrual function often causes the metabolic rate to drop sharply. Advanced pulmonary tuberculosis, with slight hemorrhage, is favorably affected by menostasis.

FRANCIS B. SHELDON, M.D.

Large Coralliform Kidney Stones and Their Treatment. James Thomas Nix. Urol. and Cutan. Rev., October, 1931, XXXV, 631-634.

The author discusses two cases, presenting large coralliform kidney stones, and the methods of treatment employed.

The first case record was that of a white female, 55 years of age, who complained of dull pain in the left lumbar and lower dorsal regions. A stone had been removed from the left kidney nineteen years previously. Three years before admission, following an attack of severe pain of 48 hours' duration in the left lumbar region, the patient passed a stone in the urine and felt very much relieved. X-ray examination at this time revealed a large stone in the left kidney. Two weeks before seeking admission the patient again experienced a similar attack of pain. Operation at this time revealed a large coralliform stone, with destruction of the kidney structure. Nephrectomy was accordingly performed and the patient made an uneventful recovery.

The second case was that of a white male, 43 years of age, who, while at work, "felt something drop inside of him." Following this he suffered from rather sharp pains in the lower abdomen, associated with frequent and painful urination. Roentgen examination revealed a bladder calculus and large stones in the kidneys. The phenolsulphonephthalein test at this time was 55 per cent. Urinalysis revealed red blood cells and pus. The bladder stone was removed by suprapubic cystotomy, uneventful recovery resulting. After discharge from the hospital the patient disappeared for three years. He returned because of pains over the right kidney region. X-ray examination showed an increase in size of the calculi previously observed. The phenolsulphonephthalein test at this time was 45 per cent, and gradually decreased to 15 per cent. While this patient's condition has remained practically stationary, the author considers that the real chance for a cure was lost when he failed to return after the cystotomy, as he had been instructed.

The author offers suggestions for consideration in the treatment of large coralliform calculi. Unilateral stones, in cases in which the opposite kidney is good, should be removed by pyelotomy or pyelonephrotomy. Nephrectomy should be reserved for those cases in which the kidney is destroyed. Slight impairment of the opposite kidney is not a contra-indication, but often aids in the restoration of function on the side upon which operation has been done.

Cases of bilateral stag-horn calculi are divided into two groups. The first group includes those patients in poor physical condition because of pathology elsewhere. In this type of case surgical measures should be postponed until the patient's condition improves. The second group includes those cases in which there is some disproportion in the involvement and infection present on the two sides. Surgical intervention is permissible in those cases in which the calculus may be removed without causing much kidney damage. A sufficient interval should always be allowed between operative procedures on the separate kidneys to permit satisfactory repair and restoration of function of the kidney operated upon. The patient should in any case be kept

under a constant observation which should include urinalysis, functional tests, and roentgenograms.

J. N ANÉ, M.D.

GYNECOLOGY AND OBSTETRICS

Roentgenographic Diagnosis of Diseases of the Breast. Paul S. Seabold. Surg., Gynec. and Obst., October, 1931, LIII, 461-468.

The author describes the normal breast as having continued changes caused by age, adiposity, puberty, menstrual cycle, menopause, and pre-existing pathology.

Breasts before puberty are difficult to show radiographically. Breasts before the climacterium vary in architecture by the stage of the menstrual cycle. There is a triangular area in a breast, with the apex towards the nipple. This is shadowed by well-defined lines which are cast by the lactiferous ducts and their fibrous tissue. The first few days after menstruation begins these lines are increased in density, are clear cut, and radiate from the main ducts just behind the nipple. This is called the striated breast triangle. These striations become less distinct as the next period approaches and then are wave-like. Striations at right-angles are developed, which reach a maximum opacity ten days prior to the beginning of menstruation. The breast reaches its greatest compactness at this time. Normal lymph nodes do not cast a shadow.

Little change is noted in a breast before six months of pregnancy. After this time the wave-like appearance is more pronounced and heavier.

After the menopause the triangular striations are crowded together, producing a heavier, more dense triangle. Small oval masses of density caused by small cysts may be seen.

Malignancy of the breast is shown by the disruption of the normal triangle, and in place of striations there is a concentric, whorling appearance, with greatest opacity at the central portion of the mass, the edges of which are quite irregular. In many tumors there is a band-like radiation from the tumor mass to the nipple. Metastasis is demonstrated as a faint opacity cast by pectoral or axillary lymph nodes. However, nodes of inflammatory origin may have a like appearance although perhaps a little less dense. Differentiation of abnormal involution from malignancy is difficult, but involution is shown as small oval areas of varying density with well-defined borders.

Benign tumors are localized, do not spread, have well-defined borders, and the linear triangular striations are crowded to one side to make room for the growth. A cyst is less dense than a solid tumor.

There is no bibliography given.

DONALD S. CHILDS, M.D.

Studies of the Time Factor. Hermann Wintz. Strahlentherapie, Oct. 24, 1931, XLII, 591-598.

The effect of the time factor on the reactions following irradiation was studied in cases which received a sterilizing dose of roentgen rays. If 34 per cent H.E.D. effective in the ovaries was applied in one single sitting on the fifth day after the beginning of the menstruation, 95 per cent of these patients did not menstruate any more, and 5 per cent had one more menstruation. After three years all cases still had amenorrhea. The same result was obtained if the same dose was given in one sitting on the eighth day after the beginning of the menstruation.

In another group, 17 per cent H.E.D. was given on the fourth and 17 per cent on the eighth day after the beginning of the menstruation. In 21 per cent, one menstruation occurred; in 32 per cent, two menstruations; in 45 per cent, three menstruations, and in 2 per cent, four menstruations after the treatment. Three years later, 78 per cent had still amenorrhea, while in 2 per cent menstruation recurred after the first year; in 15 per cent after the second year, and in 5 per cent after the third year.

Another group received 20 per cent on the fourth and 20 per cent on the eighth day after the beginning of the menstruation. One menstruation occurred in 72 per cent, two menstruations in 24 per cent, and three menstruations in 4 per cent of the cases after the

treatment. Amenorrhea was present in all cases three years later.

Another group received 25 per cent on the fourth day and 25 per cent H.E.D. on the eighth day after the beginning of the menstruation. After the treatment, 86 per cent had no menstruation, 12 per cent had one, and 2 per cent of the patients, two. Amenorrhea was still present in all patients three years later.

The next group received 28 per cent of the H.E.D. on the fifth day after the beginning of the menstruation. One menstruation occurred in 12 per cent, two in 22 per cent, three in 57 per cent, and four in 9 per cent of the patients. After three years all patients were menstruating again, the period of amenorrhea having varied from twenty-three to thirty-one months.

The last group received 14 per cent H.E.D. on the fourth day and 14 per cent on the eighth day after the beginning of the menstruation. In sixteen women the menstruation was not interrupted. In one patient the menstruation stopped for three months, beginning six months after the treatment, and in another patient it stopped for four months, beginning five months after the exposure.

The figures of this statistical survey are self-explanatory. In comparing the susceptibility of the graafian follicles and of the primordial follicles it appears that the cells with more active mitosis recover much easier, while the cells at rest cumulate the applied dose almost completely.

ERNST A. POHLE, M.D., Ph.D.

Is the Oviduct Open? Lawrence D. Smith. Jour. Iowa St. Med. Soc., February, 1931, XXI, 77-80.

The answer to a patient's query as to why she cannot become pregnant is not always easy. A complete history of wife and husband is necessary; then a thorough physical examination of both. If both are found to be normal, the patency of the oviducts is tested by injecting them with iodized oil under fluoroscopic guidance. If the tubes are occluded, re-radiate in twenty-four hours. The author discusses the therapeutic value of this procedure. Contra-indications are given as carelessness and incompetency; recent uterine bleeding; active infection; recent uterine intervention; uterine pregnancy; malignancies or polyps of the uterus; fever; latent streptococcic salpingitis.

W. W. WATKINS, M.D.

Traumatic Separation of the Symphysis Pubis. Ward L. Ekas. Am. Jour. Obst. and Gynec., May, 1931, XXI, 681-689.

According to reported cases, separation of the symphysis pubis occurs infrequently in pregnant women. It is estimated as occurring in about one out of 25,000 cases. Wishner and Mayer believe it is not as rare as supposed but is often overlooked. Separation of the symphysis is often associated with injury to the sacro-iliac articulation. The amount of separation of the symphysis which can occur without having an associated sacro-iliac injury has been variously estimated by different authors from 3 millimeters to 7 centimeters.

Traumatic separation of the symphysis pubis may be caused by falls, severe strains, forcible separation of the thighs, and internal pressure as in pregnancy. Predisposing causes are diseases of the pelvic joints, disproportion, increased mobility during pregnancy, or repeated pregnancies. Kehrer describes the formation of cavities or softening in the pubic cartilage or capsule as a predisposing cause. Caries, rachitis, osteomalacia, chronic arthritis, trauma during pregnancy, and congenital weakness may predispose toward rupture. Sixty-seven per cent of DeLee's cases occurred in forceps deliveries.

Prognosis is, as a rule, good. Complications, as ruptured bladder, fever and sepsis, embolus, are often serious. There is rarely a return when the capsule is torn and subsequent labors are usually easy.

JACOB H. VASTINE, M.D.

Eight Years' Experience with Roentgen Diagnosis in Gynecology: Pneumoperitoneum and Lipiodol in Pelvic Diagnosis. Irving F. Stein. Am. Jour. Obst. and Gynec., May, 1931, XXI, 671-679.

Pneumoperitoneum and lipiodol in pelvic

diagnosis are methods of precision and accuracy. They are safe if ordinary care and skill are employed and if the indications and contra-indications are carefully observed. The contra-indications to lipiodol instillation are bleeding from the uterus, pregnancy, infected interi, and virginity. No accident or complication was encountered by the author in 530 cases of pneumoperitoneum, in 200 of which lipiodol was also employed.

In cases of sterility, the Rubin test should first be employed to determine the patency of the tubes. Introduction of an opaque oil into the uterus, in addition to the Rubin test, is often necessary and demonstrates the point of obstruction. The size and shape of the uterine cavity are of importance. To attempt to diagnose tumors, cysts, and tubal pregnancy by lipiodal instillation is apt to lead to error. For intra-uterine pregnancy it is meddlesome, dangerous, and should be avoided.

Pneumoperitoneum in pelvic diagnosis.—A liter of CO_2 is introduced into the peritoneal cavity either by the transuterine or transabdominal route, according to the method described by Peterson in 1921. The uterus, ovaries, fallopian tubes, and bladder are regularly shown and the round ligaments are sometimes seen. The presence or absence of pelvic viscera, when in question, hypoplasia, etc., are demonstrable. Adhesions of the viscera can usually be demonstrated. Intra- and extra-uterine pregnancy (from five to six weeks' duration), lutein, and other cysts of the ovary may be graphically differentiated. Fibroids can usually be easily differentiated.

Combined lipiodal instillation and pneumoperitoneum have been used by the author in over 200 cases and found to be advantageous in establishing the correct diagnosis.

JACOB H. VASTINE, M.D.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Contributions to the Study of Congenital Malformations of the Heart. Antonino Perez Ara. Rev. Medicina y Cirugia, Habana, Sept. 30, 1931, XXXVI, 657-682.

The author gives in this paper a fair outline of congenital malformations of the heart. He presents the case of a goat with an extra-thoracic heart, showing pictures and radiographs of the same. In this case, the auricles were inside the thorax, while the myocardium was outside.

N. G. GONZALEZ, M.D.

The Importance of Anomalies of the Superior Vena Cava in Man. J. Beattie. Canadian Med. Assn. Jour., September, 1931, XXV, 281-284.

The author refers to the work of Köhler in calling attention to the importance of a careful study of the aortic arch and associated vessels in roentgenograms of the thorax. The superior vena cava is visible in almost every case after the thirty-fifth year, forming a part of the "aortic" or "vascular" shadow in frontal and oblique films. In oblique views the so-called "aortic shadow" has its posterior edge formed by the superior vena cava, or the vena cava projects a little way behind it. It follows, therefore, that an estimate of the diameter of the aorta must take into account the position and size of the superior vena cava. Hence, anomalies of the large venous trunks in the upper thorax take on some practical importance in the radiologic diagnosis of thoracic conditions.

The main venous trunks of the head and arm in the early embryo consist, as in the adult, of an internal jugular vein and a subclavian vein which unite to form a large venous trunk on each side of the body. These veins (the "anterior cardinal" veins of the embryologist) pass vertically downward into the thorax and unite with two corresponding posterior cardinal veins to form two (a right and a left) large venous trunks which enter the primitive heart. Cross-anastomoses between the two anterior cardinal veins are developed, but only one of these, which lies at the root of the neck, persists in the adult. Changes take place in the lower part of the left anterior cardinal vein which result in the switching of all the blood from the left side

of the head, neck, and left arm and from the left anterior cardinal vein into the right anterior cardinal by way of the cross-anastomosis between the two veins. Parts of the left anterior cardinal vein persist, but are not normally in continuity with the upper part of the original vessel. The cross-anastomosis between the two primitive cardinal veins becomes the left innominate vein.

From a practical standpoint, anomalies of the superior vena cava can be divided into three classes: (1) Persistence of both primitive anterior cardinal veins and the normal cross-anastomosis between them; (2) persistence of both primitive anterior cardinal veins, but with no cross-anastomosis between them; (3) persistence of the left anterior cardinal vein, with obliteration of the right. Persistence of the right anterior cardinal vein with obliteration of the left is the normal arrangement.

The author has been able to find 175 cases of abnormalities of the superior vena cava, including the three which he himself reports. He concludes that these abnormalities are not incompatible with life, and that Types 1 and 2, as indicated above, are more numerous than Type 3.

The three cases reported by the author illustrate the three types as classified above. They were all obtained postmortem from bodies of adults ranging from 50 to 70 years. They illustrate three stages in the transition from the normal to the completely abnormal condition of a left superior vena cava. The first specimen showed a left superior vena cava alongside a fully developed right vena cava. The second resembled the first, but there was no cross-anastomosis, whereas there was a small one in the first specimen. The third specimen represented the complete abnormality in that the right vena cava was entirely absent, while a left vena cava was fully developed. A cross-anastomosis drained the blood from the right side of the face and neck into the left vena cava.

L. J. CARTER, M.D.

Traumatic Aneurysm of the Subclavian Artery as a Late Complication of Fractured Clavicle. E. H. Cayford and F. J. Tees. Canadian Med. Assn. Jour., October, 1931, XXV, 450-452.

This is a case report of a young man, aged 22, who, while playing football, in 1926, broke his clavicle in a forward lunge across the turf. A surgeon set it with apparently good result. His father recalls that at the time there was a great deal of swelling. No X-ray films were taken.

In January, 1931, he complained of pain and tingling in the left arm and hand, the latter also being cold. He had noticed that the pulse of the left wrist had disappeared. Examination showed a large callus at the site of the old fracture, about the middle of the left clavicle, and a palpable mass behind it. The mass was not definitely expansile, though pulsation was easily felt. Auscultation above the clavicle revealed no bruit. X-ray examination showed a rounded tumor, 3½ cm. in diameter, situated behind the left clavicle and in contact with it. At operation the clavicle was dissected off the mass, and a clearly defined aneurysm of the subclavian artery was found. It was the size of a walnut and wedged in between the clavicle and the first rib. It was calcified laterally and fixed behind and in front to the first rib and the clavicle. The main portion of the mass was removed, a modified Matas endo-aneurysmorrhaphy being done. The repair was supported with the sheath of the subclavian muscle.

About four weeks later a mass appeared suddenly at the site of operation, accompanied by excruciating pain about the neck and arm. At operation a large laminated clot was found lying between the tissue layers. On manipulation the clot gave way and the gush of arterial blood was stopped by corking the artery with the finger. Ligatures *en masse* were passed until all bleeding ceased, the vein as well as the artery being occluded in the process. There was some edema of the extremity during convalescence and considerable pain in the index finger and thumb, but capillary circulation was maintained and the arm and hand remained warm. When last seen, about four months later, there was no evidence of sensory or motor disturbance and the patient enjoyed the full use of the arm.

The authors conclude that it would have been better to have adopted a less conservative attitude at the first operation, and at that time to have tied off the artery and accompanying vein.

L. J. CARTER, M.D.

A Case of Enormous Antemortem Dilatation of the Heart. Antonino Nicotra. Archivio di Radiologia, May-June, 1931, VII, 473-479.

A boy, 22 years of age, had an X-ray examination made of his thorax. The radiograph (illustrated) showed a median shadow occupying three-fourths of the right hemithorax. Without autopsy control, the author thinks it a case of enormous dilatation of the right auricle and ventricle, since all other possibilities were eliminated in making the diagnosis.

E. T. LEDDY, M.D.

A Case of Multiple Aneurysms of the Aorta and Great Vessels. H. F. Mowat. Canadian Med. Assn. Jour., October, 1931, XXV, 453, 454.

Multiple aneurysms are usually more frequent in the larger arterial trunks, especially the thoracic aorta. Klotz collected 695 cases of thoracic aneurysm, and found that 70, or 9.8 per cent, were multiple in type. The series included saccular, dissecting, and fusiform varieties. Colt made a comprehensive survey of aneurysms in the British Isles, and found 575 dependable records of thoracic aneurysm. Multiple saccular dilatations were found in 59, or 9.1 per cent. Boinet reported 31 cases of multiplicity in 340 cases of thoracic aneurysms, or 11 per cent.

The author reviews 26 cases of aneurysm of the thoracic aorta found in 1,862 autopsies performed in the Department of Pathology of the University of Toronto since 1925. Of these, two cases were multiple. Both were due to syphilitic invasion of the arterial wall. Campbell Howard points out that this is always the cause of the multiple saccular type of thoracic aneurysms. This point is borne out by Graves, who reports 45 thoracic aneurysms occurring in 1,595 postmortem examinations. Of these, six were multiple, and all six were due to syphilis.

The case reported by the author was that of a white male 55 years old, by occupation an iron worker. The family history was negative. No history of abortions or premature deliveries by his wife was given. Syphilis was denied. There was no history of alcoholism or the use of tobacco. His complaints were of hoarseness and a non-productive cough of five months' duration. There had been a loss of fifteen pounds in weight. Slight dyspnea and mild attacks of dizziness were complained of on exertion. There was complete paralysis of the right vocal cord.

X-ray examination of the chest revealed an aneurysm of the ascending aorta and the innominate artery. The blood Wassermann test was strongly positive. Following intensive anti-syphilitic treatment the patient returned to work after three months. Subsequently, he died suddenly on the street.

The postmortem findings were those of multiple aneurysms of the thoracic aorta, beginning at the aortic cusps and the sinuses of Valsalva, the innominate artery, the subclavian artery on the left side, and the transverse aorta. The right recurrent laryngeal nerve was adherent to the aneurysm of the arch, and was atrophied.

L. J. CARTER, M.D.

Heart Conditions Simulating Acute Abdominal Symptoms. Gerald R. Burns. Canadian Med. Assn. Jour., October, 1931, XXV, 424-428.

This is a presentation and analysis of a number of cases, with the idea of showing that, without the X-ray or electrocardiograph, a differential diagnosis can be made and the important decision as to medical or surgical treatment indicated. The author states that within the last fifteen months he has seen four cases of coronary artery thrombosis which were sent into the hospital with the diagnosis of acute abdominal emergency.

Three illustrative case histories are cited.

The first, a farmer, aged 46, was admitted,

complaining of severe abdominal pain, centered in the epigastrium. He was in a condition of shock. The diagnosis was ruptured gastric ulcer. He had a history of acute rheumatic fever seven years before. During the past two years he had experienced increasing shortness of breath, and had had several attacks of moderately severe pain in the stomach, diagnosed as acute indigestion. The admission diagnosis was not confirmed, but a diagnosis of coronary artery thrombosis was made. This was confirmed later by the electrocardiograph.

The second, a farmer, aged 45, was admitted complaining of severe pain below the sternum. The diagnosis was acute abdomen. After examination, a diagnosis was made of coronary artery thrombosis, and the patient was saved an unnecessary operation called for by the admission diagnosis.

The third, a farmer, aged 46, was admitted, with a history of two years' duration of attacks of abdominal pain, centering in the epigastrium and relieved by vomiting. A diagnosis of angina pectoris was made.

In all of these cases, in spite of the apparent reference to the abdomen, there were definite heart findings, which should have indicated the diagnosis. In all, the heart was enlarged to the left, there was some cyanosis, usually a precordial rub or friction sound, no definite localized area of acute tenderness in the abdomen, and the pain was made worse by exertion.

Thrombosis of the coronary artery is by far the worst offender in the class of cardiac conditions which may offer some difficulty in differentiation from acute abdominal conditions. There is an acute attack of angina not relieved by amyl nitrite but only by repeated large doses of morphine. When the pain, instead of radiating down the arm, radiates toward the abdomen, as in the cases cited, the diagnosis offers some difficulty.

In the examination of the patient, one of the most important points is that the history of the illness should be unbiased and accurate. Special attention should be given to the family history, as regards death from high blood pressure, apoplexy, angina pectoris, and so-called acute indigestion, or any sickness on the patient's part that might lead up to these conditions.

The characteristic things that point to coronary thrombosis are: (1) The tinge of cyanosis about the tips of the nose and fingers, the lobes of the ear, and lips; (2) the stillness of the patient, as contrasted with the restlessness of the abdominal patient; (3) the drop of the blood pressure from a previously high level; (4) the enlarged heart, which is rapid; (5) the adventitious heart sounds which are usually present.

The fever, upper abdominal tenderness, leukocytosis, and pain in the epigastrium, are more or less features common to coronary thrombosis and acute abdominal conditions, and offer no special aid in the differential diagnosis. Angina pectoris is differentiated by the fact that the pain produced by it is relieved by amyl nitrite, while the pain of coronary artery thrombosis is relieved only by large doses of morphia.

The electrocardiograph gives a characteristic tracing.

L. J. CARTER, M.D.

CHEMICAL ABSTRACTS

The Magnetic Spectrum of α-rays from the Active Deposit of Actinon. Mme. P. Curie and S. Rosenblum. Compt. rend., 1931, CXCIII, 33-35.

The source of Act has previously been described. The oxides obtained from the oxalates were dissolved in HNO_3 and La was precipitated with NH_3. Part of the Act X was then precipitated with $(NH_4)_2CO_3$ and later converted to the fluoride. The remainder was carried down with $Fe(OH)_3$. Both products were used to obtain an active deposit by placing them in a brass tray having an insulated cover on which was attached a bit of Au (2×0.01 cm.). An electromotive force of 1,000 V. was set up and the active deposit collected on the Au cathode, with about 30 per cent yield in eight days. By means of a large electromagnet the following ratios were measured: $V_{\alpha 1}/V_{\alpha} = 0.973$ and $V_{\alpha 2}/V_{\alpha} = 1.062$,

where V_α is the velocity of the more intense of the two strong rays, α and α_1, due to Act C, and $V_{\alpha 2}$ is the velocity of the weak ray due to Act C'. The difference $\alpha - \alpha_1$ corresponds to 352 K.V. electrons; a group of γ-rays of this energy is attributed to Act C".

CHEMICAL ABSTRACTS.

The Distinction of Analcime from Leucite in Rocks by X-ray Methods. F. A. Bannister. Mineralog. Mag., 1931, XXII, 469-476.

Powder photographs have satisfactorily confirmed the identity of analcime phenocrysts in blairmorites from Lupata Gorge. Laue photographs using monochromatic radiation indicated that the phenocrysts were made up of smaller individuals in sub-parallel position. The X-ray data are tabulated.

CHEMICAL ABSTRACTS.

The Relation between Long-range Alpha Particles and Gamma Rays. Mme. P. Curie. Compt. rend., 1930, CXCI, 1055-1058.

There seems to be some plausibility in the theoretical view that α-particles of average range come from the normal nuclear level, while those of long range come from an upper nuclear level. For Th C' and Ra C, the agreement of experiment with this view is not good, but experimental work is still incomplete.

CHEMICAL ABSTRACTS.

Fine Structure in the X-ray *K*-series Absorption Edges of Elements of the Middle Range of Atomic Number. Heinz-Theodor Meyer. Wiss. Veröffentlich. Siemens-Konzern, 1931, X, No. 2, pp. 95-98.

Photometric curves of photographic spectra of the X-ray critical absorption limits of compounds of Rb, Sr, Y, Zr, Cb, and Mo are reproduced. Fine structure is indicated in some cases, but it is very faint. It is stated that an examination of higher compounds of Se and As shows a well-developed fine structure similar to that previously found for Br compounds. The results are in agreement with the general rule that fine structure is found principally in the higher states of combination of elements, which have multiple valences.

CHEMICAL ABSTRACTS.

The Radio-activity of Air, Oxygen, and Carbon Dioxide. Gust A. Aartovaara. Tek. Fören. i Finland Förhandl., 1931, LI, 211-215.

Finely divided U and Th minerals were suspended in colloidal solutions, and the radioactive emanation carried off by air which passed through them was measured over a period of three years. The amount fell to about 3 per cent of the original during that period. This aging process became much more pronounced when the O was supplied under pressure. It is therefore concluded that the use of radio-active O for inhalation can be effective only for short periods. Cylinders of CO_2 also showed a marked radio-activity, presumably because the Rn in the air is liquefied with CO_2. An investigation of carbonated drinks showed the activity varied from 20 to 100,000 Mach units. It is suggested that this may account for the success which has been attained with CO_2 snow in curing leprosy and in transportation of foods.

CHEMICAL ABSTRACTS.

Roentgenographic Investigation of the Orthotitanates. Sven Holgersson and Adolf Herrlin. Ztschr. anorg. allgem. Chem., 1931, CXCVIII, 69-78.

Mg, Co, Zn, and Mn orthotitanates were prepared synthetically by fusion of the metallic oxides with TiO_2 at 1000°. All of the orthotitanates belong to the spinel type, with dimensions as follows: Mg_2TiO_4: $a = 8.44$ Å.U.; Co_2TiO_4: $a = 8.43$ Å.U.; Zn_2TiO_4: $a = 8.44$ Å.U.; Mn_2TiO_4: $a = 8.67$ Ångström units.

CHEMICAL ABSTRACTS.

The Radio-activity of Potassium and Rubidium Measured with a Geiger Counter. W. Mühlhoff. Ann. Physik, 1930, VII, 205-224.

The absorption coefficient of the γ-radiation of K in Pb was, $\mu_{Pb} = 0.59$ cm.$^{-1}$, with γ-ray

measurements of Ra C and Th C as standards. Insufficient Rb precluded measuring its γ-ray activity. Comparison with a standard 0.03 mg. Ra sample gave the ratio of the intensity of the γ-radiation of Ra C (in equilibrium with Ra) to that of K as 3×10^{10}:1. β-ray activities gave intensities K:Rb:U = 1:16:500, if U X_1 is considered as the only β-radiator in U.

CHEMICAL ABSTRACTS.

A Precision X-ray Spectrometer and the Wave Length of Mo $K\alpha_1$. Arthur H. Compton. Rev. Sci. Instruments, 1931, II, 365-376.

The instrument has two crystals in series: the first is mounted on an arm projecting from the frame, the second is placed on the central table whose position is read from a precision circle. For the $K\alpha_1$ line of Mo the reflection maxima from calcite (cor. to 18°) occur at $\theta_1 = 6°42'35.5''$ and $\theta_4 = 27°51'33.0'' \pm 0.25''$ in each case. If the apparent grating space for the first order is 3.02904 Å.U., then $\lambda = 707.830 \pm 0.002$ Å.U. Comparison of θ_1 with θ_4 gives n for calcite, $1 - \mu = (2.10 \pm 0.15) \times 10^{-6}$.

CHEMICAL ABSTRACTS.

The X-ray Classification of Epidermal Proteins. Thora C. Marwick. Jour. Textile Sci., 1931, IV, 31-33.

X-ray photographs, four of which are given, demonstrate the existence of at least three different forms of keratin. Natural silk is probably in an extended state, since its X-ray photograph resembles that of hair or wool stretched artificially.

CHEMICAL ABSTRACTS.

Industrial and Chemical Research with X-rays of High Intensity and with Soft X-rays. George L. Clark and Kenneth E. Corrigan. Ind. Eng. Chem., 1931, XXIII, 815-820.

A high-power X-ray tube is described with which diffraction photographs have been obtained in one-twentieth of a second and which permits visual observation of diffraction patterns on a fluorescent screen. The authors also describe a tube combined with an evacuated diffraction camera in which X-rays of long wave length (about 10 Å.U.; Mg K) are utilized. Preliminary work on rubber and cellulose reveals some long spacings of the order of 200 Ångström units. Important applications for these developments are outlined.

CHEMICAL ABSTRACTS.

Nature of Eutectoid Transformation of Aluminum Bronze. III.—X-ray Analysis. IV.—X-ray Analysis at High Temperature. Ichiji Obinata. Mem. Ryojun Coll. Eng., No. 4B, 1931, III, 285-294, 295-298.

Alloys were prepared by melting in a graphite crucible under salt coverings and then sucked up into magnesia capillary tubings of about 1- to 1.5-mm. bore, to make rod-shaped specimens. After having been heat-treated, they were subjected to X-ray analysis. X-ray analysis of a saturated solid solution of the α- and δ-phases, the latter containing 16 per cent Al, has confirmed that it has a face-centered cubic lattice and a cubic lattice containing 52 atoms in the elementary cell. The photogram obtained from the quenched alloy containing 16 per cent Al showed no differences in the distribution of the spectral lines, as compared with those obtained from the annealed one. The quenched alloy containing 12.5 per cent Al consists essentially of the β'-phase mixed with a small quantity of the β-phase, in which the former was found to have a hexagonal-lattice construction: $A = 11.13$ Å.U., $C = 6.342$ Å.U., while the latter had a body-centered cubic super-lattice, having a parameter of 5.835 Ångström units. The decomposition of the β-phase into the β' is retarded on quenching, either when quenched in toluene cooled to a very low temperature, or when Mn is added. X-ray analyses of the tempered alloys containing 12.5 per cent Al have confirmed that the change $\beta \rightarrow \beta'$ takes place between 400° and 450°, and that the change $\beta' \rightarrow \alpha + \delta$ is nearly completed at 500°. By using a high-temperature camera, a powder photogram of a fine rod of Al bronze containing 87.62 per cent Cu was taken at about 650°. This confirmed that at 650° this alloy consists solely of the β-phase, which is a

body-centered cubic super-lattice, having a parameter of 5.887 Ångström units.

CHEMICAL ABSTRACTS.

A Study of Tendons, Bones, and Other Forms of Connective Tissue by Means of X-ray Diffraction Patterns. Janet H. Clark. Am. Jour. Physiol., 1931, XCVIII, 328-337.

Inorganic crystals of apatite are present in bone, oriented so as to give fiber structure in longitudinal section. Unoriented crystals are present, which are thought to be organic crystals of collagen or ossein. Dentine contains unoriented inorganic crystals of apatite and also, probably, unoriented crystals of collagen. Tooth enamel contains only inorganic crystals of apatite, oriented with respect to the prisms so as to give a fiber pattern.

CHEMICAL ABSTRACTS.

The Ultra-violet Light Absorption of Ethyl Alcohol Purified by Different Methods. Philip A. Leighton, R. W. Crary, and L. T. Schipp. Jour. Am. Chem. Soc., 1931, LIII, 3017-3019.

Measurements of the absorption coefficients of EtOH, purified in various ways, in the region of 2,500–3,000 Å.U. show it to be a very delicate method for determining impurities. The measurements indicate that the standard practice of drying over CaO should be carried out in an O-free atmosphere. The highest purity was obtained by the use of Al amalgam.

CHEMICAL ABSTRACTS.

Theory of X-ray Absorption. J. Fischer. Ann. Physik, 1931, VIII, 821-850.

Absorption coefficients for X-rays and angular distribution of photo-electrons from K and L shells are calculated, relativistic effects (except "Doppler") being disregarded. Within these limits the calculations of Sommerfeld and Schur are checked, and the results agree with experiments.

CHEMICAL ABSTRACTS.

PHYSICAL ABSTRACTS

Wave Length Standards in the Extreme Ultra-violet Aluminum Spectrum. Jonas Söderqvist and Bengt Edlén. Ztschr. Physik, 1931, LXIX, 356-360.

A list is presented of about 50 accurately measured wave length standards in the Al spectrum, extending from 312 to 68 Å.U. in the extreme ultra-violet. The wave lengths were derived by comparison of the higher orders of the lines with the Fe standards between 4,500 and 2,300 Å.U. The Al lines were emitted by a high potential spark discharge in vacuum and belong to Al IV and higher stages of spark spectra.

CHEMICAL ABSTRACTS.

Temperature Effect in Diffuse Scattering of X-rays from Rock Salt. W. D. Claus. Phys. Rev., 1930, XXXV, 1427.

Experiments conducted to test the effect of temperature on the scattering of X-rays indicate in the range from 295° to 135°, a much smaller decrease than that expected from the Debye equation.

CHEMICAL ABSTRACTS.

Diffuse Scattering of X-rays from Sylvine at Low Temperature. G. E. M. Jauncey and G. G. Harvey. Phys. Rev., Dec. 1, 1931, XXXVIII, 1925-1931.

By use of a modification of the photographic method described by Claus, the authors have compared the intensities of X-rays of wave length 0.43 Å., diffusely scattered from sylvine at angles in the range 25° to 90° at a temperature of 90° K, with the intensities at these same angles at a temperature of 300° K. The authors have shown that the intensity of the diffusely scattered rays should be given by $S = S' - F^2/Z$, where S' is independent of the temperature and F is the atomic structure factor containing the effect of thermal agitation. With James and Brindley's F values at 90° K and 300° K, theoretical values of S for 90° K have been calculated. The experimental S values at 90° K are lower than the theore-

tical S values. This result is in accord with that found by Claus for rock salt. Plotting $\log (S' - S_1)/(S' - S_2)$, where the subscripts refer to the two temperatures, against $(\sin^2\phi/2)/\lambda^2$, a straight line is obtained whose slope agrees with that required by the Waller and not the Debye formula for the temperature effect. It is impossible by means of this experiment to show whether or not there is zero point energy. In order to do this, an assumption concerning the electron distribution in the atom must be made.

THE AUTHOR.

Higher Order Effects in the Diffraction of X-rays by Liquids. W. C. Pierce. Phys. Rev., Oct. 15, 1931, XXXVIII, 1413-1419.

The X-ray diffractions of liquid carbon tetrachloride, chloroform, benzene, solutions of carbon tetrachloride in benzene, o-dichlorbenzene and m-dichlorbenzene have been determined for Mo$K\alpha$ rays by the ionization spectrometer. All give a main peak characteristic of liquids and, in addition, the halogen compounds give other maxima in the intensity-angle curve at large angles. This effect is the same for carbon tetrachloride, pure or in solution, and is consequently thought to be due to internal interference caused by scattering from the chlorine atoms. Debye's relation for the scattering of single atoms cannot be applied because the positions of the peaks obtained from solutions are masked by the molecular scattering of the solvent.

THE AUTHOR.

The Regular Reflection of X-rays from Quartz Crystals Oscillating Piezoelectrically. Gerald W. Fox and James M. Cork. Phys. Rev., Oct. 15, 1931, XXXVIII, 1420-1423.

Laue patterns from quartz crystals oscillating piezoelectrically have been observed to be more intense than similar patterns from non-oscillating crystals. In this investigation, regular Bragg reflections from the face of crystals oscillating and non-oscillating have been observed in order to notice any variation in intensity or line width. No effect of this kind has been observed. These results are interpreted as negating the existence of Zwicky blocks, rocking slightly by the piezoelectric oscillations, as proposed by Langer. An explanation of the observed effect with Laue spots based upon the extinction effect in perfect crystals is proposed.

THE AUTHOR.

Precision Measurements of Air Ionization by Roentgen Rays of Definite Hardness and Homogeneity in Barrel Chambers of Smallest and Largest Size. Hans Küstner. Strahlentherapie, Oct. 3, 1931, XLII, 337-343.

The author determined the error in absolute measurements of the r due to an unsuitable diameter of the ionization chamber. Curves are presented giving quantitative data on the influence on the end-result of chamber volume, homogeneity of radiation, and scattering within the chamber. The author emphasizes the many precautions necessary in carrying out precision measurements and suggests that his data, rather than inadequate determinations, be used for corrections.

ERNST A. POHLE, M.D., Ph.D.

Lateral Space Distribution of X-ray Photo-electrons. Paul Kirkpatrick. Phys. Rev., Dec. 1, 1931, XXXVIII, 1938-1942.

The lateral distribution in space of the directions of emission of photo-electrons ejected from argon atoms by partially polarized X-rays having the mean wave length 0.53 Å. was determined by examination of photographs of 2,008 condensation tracks produced in a C. T. R. Wilson expansion apparatus. Discarding by a definite analytical procedure the isotropically distributed emissions, which are ascribed to unpolarized radiation, the distribution of the remaining 752 tracks is found to be in excellent agreement with the indications of quantum mechanics that (for K electrons) the probability of emission is proportional to the square of the cosine of the angle between the electric vector of the absorbed radiation and the projection of the direction of emission upon a plane normal to the direction of incidence.

THE AUTHOR.

The Reasons for the Broadening of X-ray Diffraction Lines with Powder and Rotating-crystal Photograms. U. Dehlinger. Ztschr. Metallkunde, 1931, XXIII, 147-149.

The broadening of diffracted X-ray lines may be ascribed to three fundamental crystallographic conditions: gradual variations within the lattice, abnormally small grains, abrupt variations within lattice. Gradual variations may be of two types: variations in lattice parameter originating in concentration differences in solid solutions, and those originating in elastic distortion. The variations in lattice constant must be approximately constant within a range of at least 0.5μ. A concentration variation of 3 per cent Zn in a Cu-Zn alloy will cause a broadening equal to the distance between the lines of the $K\alpha$ doublet from Cu. Elastic distortion, caused by strains, must likewise be approximately constant within a range of 0.5μ. Failure to fill this condition results only in a displacement and of a broadening of line. A grain size less of pressure and temperature of the I_2 vapor gave the effective cross-section in collisions of the excited Na atoms with I_2 molecules or atoms. In the first case a corresponding decrease in effective cross-section was found for increase in velocity of the Na atoms. For collisions with I_2 atoms the effective cross-section is about ten times smaller than the maximum value for collisions with molecules and shows no decided dependence on velocity.

CHEMICAL ABSTRACTS.

Absorption of Soft X-rays in Gases. R. G. Spencer. Phys. Rev., Dec. 1, 1931, XXXVIII, 1932-1936.

A crystal spectrograph for measuring absorption coefficients of soft X-rays in gases has been constructed, and with it absorption coefficients of air, argon, and oxygen have been measured for spectral lines of wave lengths 1.537, 2.284, 4.145, and 6.973 Ångströms. Absorption coefficients in the regions immediately adjacent to the K absorption limit of argon have been measured with general radiation. No departure from the ordinary absorption law greater than experimental error was found in these regions. The magnitude of the K absorption discontinuity of argon was measured by a method which is not dependent upon the extrapolation of curves to the absorption limit, and also by a method which is independent of the absolute magnitude of the absorption coefficients on either side of the absorption limit.

THE AUTHOR.

The Production of Intense Monochromatic X-rays with Technical Tubes without Spectral Apparatus. Hans Küstner. Ztschr. Physik, 1931, LXX, 324-347.

By means of a differential method, using selective filtering, very intense and highly monochromatized radiation was obtained. The $K\alpha,\alpha'$ doublet was obtained practically pure.

CHEMICAL ABSTRACTS.

The Effect of General Radiation in the Diffraction of X-rays by Liquids. W. C. Pierce. Phys. Rev., Oct. 15, 1931, XXXVIII, 1409-1412.

Previous work has shown that the amount of general radiation transmitted by a single filter may cause peaks in the diffraction pattern of liquids. Balanced strontium and zirconium filters are used to study the magnitude of this effect in X-rays from a molybdenum tube operating at 35 K.V. Zirconium alone does not give sufficient filtration under these conditions, but by use of the two filters the effects of the general and characteristic radiation may be completely separated.

THE AUTHOR.

The Scattering of X-rays from Paraffin, Aluminum, Copper, and Lead. Allen W. Coven. Phys. Rev., Oct. 15, 1931, XXXVIII, 1424-1431.

The radiation from a tungsten-target X-ray tube operated at 80 K.V. was filtered through 0.244 cm. of aluminum, and the intensities of the scattered radiations from paraffin, aluminum, copper, and lead were observed by the ionization method. The scattered intensities at angles in the range of 30° to 120° with the forward direction of the primary beam were

compared with the scattered intensities at 90 degrees. Values of the intensity at 90° for paraffin were compared with the intensity at 90° for the other materials. The scattering from paraffin and aluminum was at an effective wave length of 0.32 Å.; from copper 0.26 Å., and from lead 0.27 Å. The Dirac value of the scattering from paraffin at 90° was used as the basis for calculating the absolute values of the scattering per gram and the scattering per electron.

THE AUTHOR.

A Classical Effect of the Scattering of Radiation. Otto Halpern. Ztschr. Physik, 1931, LXVII, 523-530.

It is pointed out that the light scattered by an isolated oscillator consists not only of the coherent radiation due to the forced vibrations, but also of those frequencies which correspond to the proper frequencies of the oscillator. This is illustrated by calculating the scattered radiation when a wave of sharply cut head and tail acts on the oscillator. These considerations are also interpreted quantum-mechanically with the use of relations of Weisskopf and Wigner for the shape of a spectral line. To observe this effect, experimentally, light near the proper frequency ought to be used, or X-rays of suitable wave length.

CHEMICAL ABSTRACTS.

Origin of the Gamma Rays. Lord Rutherford and C. D. Ellis. Proc. Roy. Soc. London, C, 1931, CXXXII, 667-688.

A lengthy discussion is given on radiation and disintegration transitions from excited nuclear states, and radiationless transitions and general complexity of β-ray spectrum. All existing data on energies of γ-rays are listed and classified with an attempt to deduce a "level" system. It is found that there is, seemingly, a possible classification; inspection shows that the difference in energies between a number of the lines is approximately $0.4 \times 10^{+5}$ electron-v. or a multiple of this number. It is attempted to see whether the energies of the γ-rays can be formulated by an expression of the type $E = pE_1 - qE_2$, where p and q are integers and E_2 is a constant which is small compared to E_1. Curves showing the success of the analysis are given.

CHEMICAL ABSTRACTS.

A Small Contribution to the Chapter of Physiologic Effects of Atmospheric Electricity. C. Dorno. Strahlentherapie, Sept. 12, 1931, XLII, 87-95.

The author has written this brief article in honor of the fiftieth birthday of Professor Dessauer (Frankfort on Main). He states that the atmospheric electricity undoubtedly causes physiologic effects. The case of a major is related who, because of war injuries, suffered from tinnitus. He kept a diary for a period of several years showing the type of noise experienced during the hours of the day. Comparison of the curves plotted from these data with the changes in the atmospheric electricity showed very definite relations. Dessauer's experiments with air charged unipolar will in all probability throw further light on this interesting phenomenon.

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